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The Place of the Hypothesis in Logic

By
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IN LOGIC

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ESTHER CRANE



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INTRODUCTION

We take hypotheses so much as a matter of course in our scientific and practical thought that it comes as a shock to us to realize that traditional logic has always had great difficulty with them. There are some logicians who recognize the usefulness of hypotheses, and who give a fair scientific account of procedure by hypothesis, but who become involved in fundamental contradictions when they introduce hypotheses into their systems. There are other logicians who assert boldly that the hypothesis has no place at all in completely logical thought. Such is the opinion of Bacon, the supposed father of English empiricism, who rejects those hypotheses which the mind adds to the facts, condemns that method of investigation which "from the very beginning lays down some abstract useless generalities," and praises the method "which is by due means elicited from things" and which "rises step by step to those things which are truly in Nature more noscible" instead of attempting to omit some of the necessary steps by the use of guessing hypotheses.¹ There are certain passages where Mill asserts unequivocally that the hypothesis should not be admitted to investigations, using such expressions as: "uniformities ascertained by a perfect induction without any mixture of hypothesis," "we may rationally, and without hypothesis, conclude," and "there is thus, in Laplace's theory, nothing, strictly speaking, hypothetical; it is an example of legitimate reasoning."² Bosanquet, the objective idealist, is another logician who rejects the hypothesis as necessary to true inference, first asserting "the essential identity of Induction with procedure by Hypothesis,"³ and then stating that "Induction is not a species of inference," but instead "a transient and external characteristic of inference."⁴ Holt, the exponent of neo-realism, also objects to hypotheses because they are "deliberately added to the observed facts," whereas truth can be known only to one who is "a mere impartial witness of the events," and also because they cannot help a science which is seeking laws that "are not hypothecated or constructed 'to fit' the facts; they are found in the facts."⁵

¹ Bacon, *Novum Organon*, Book I, secs. 22-26.

² Mill, *A System of Logic*, pp. 359-60.

³ Bosanquet, *Logic*, II, 156.

⁴ *Ibid.*, p. 171.

⁵ Holt, *The Concept of Consciousness*, p. 129.

In the following detailed discussion of some of the important logicians who have failed to find a place for the hypothesis in their systems I hope to show not only that their reasons for rejecting it were not adequate, but also that they could not possibly proceed without these hypotheses, and were forced either to use them openly even though they were unable to reconcile them with their systems, or to introduce them surreptitiously under another name, or else, in the interests of consistency, to abandon the project of giving an account of thinking which discovers anything or arrives at any conclusions, and to content themselves with an account of the process of systematizing and arranging those conclusions after they have been discovered. In addition I hope to show what characteristics a logic must have if it is to escape these difficulties and to give a consistent account of the place of the hypothesis within such a system.

CHAPTER I

TWO DIFFERENT MOTIVES FOR THE REJECTION OF THE HYPOTHESIS

There is one consideration which influences practically all of the logicians who do not give the hypothesis a real place in their logic, and that is the fact that they make a complete separation between the Knower and the Known, and then consider that the hypothesis belongs wholly to the Knower, is wholly subjective. But some logicians object to this subjectivity because it is the source of prejudice and error, and because it tempts the thinker to accept the fancies and theories of his own mind instead of examining carefully the objective facts, to follow the opinions which have been taught to him instead of looking squarely at the things themselves. Others criticize it because it can never give that absolutely certain deductive whole, that complete and necessary unity which is the only true knowledge, because the introduction of anything which is hypothetical and subjective spoils the necessity and universality of valid knowledge. The former group of logicians insist that thought must apply to things, that it must relate to actual objects, that it must be free from fictions, fancies, and prejudices, and to accomplish this end they discard all mental constructions, they demand that all knowledge come from things themselves, and that the mind stand by passively and receive this knowledge as it comes. The latter group insist that knowledge must be certain and fixed; they demand universal objectivity and complete necessity; they will consider nothing valid or true if it is relative or subject to change; they admit that there is a kind of probability, a practical certainty, upon the basis of which finite affairs must proceed, but they will not admit that this has anything to do with genuine knowledge. The one side considers that truth comes from objective things whenever they are looked at thoroughly and faithfully, and fears that the hypothesis will interfere with this conscientious scrutiny of the facts. The other side considers truth to be the strict deduction of one proposition from another, and fears that the hypothesis will substitute subjective guesses for this deductive certainty, will introduce particularity and chance into this universal objectivity.

Now in the systems of most logicians these two motives are not mutually exclusive. Many logicians who feel that knowledge comes from the collection and observation of objective things entertain the same

ideal of knowledge as something universal and objective and complete which these logicians hold who obtain knowledge by a strict deductive process. Therefore, although their main motive for rejecting the hypothesis is their fear lest it will obscure the truth given them by things themselves, there is also the fear that their particularity will destroy the universality and certainty of truth.

Bacon and Descartes are good examples of those who reject hypotheses from these two causes, respectively, since in them the motives are comparatively unmixed, and therefore they show more clearly the essential similarity of the dilemma which ensues when any thinker rejects the hypothetical element, in spite of the diversity of theoretical constructions and motives from which this rejection arises. If these logicians or any others should succeed in giving an adequate account of the thinking which actually goes on in practical and scientific thought, without making any use of the hypothesis, it would be necessary to abandon the position that the hypothesis is necessary to logic. But if they are all forced to bring back the hypothetical element either under some other name, or in another mode of thought which is eagerly used, but which is ungratefully called "subordinate" and "imperfect," or if their deduction is shown to be empty and without application to new situations, that fact may stand as part proof of the thesis that it is impossible for logic to get on without hypotheses.

Bacon, of course, belongs to the first group of logicians; for he desires to proceed without the "mind" altogether, to observe and tabulate phenomena without forming any hypothesis about them, to record what he sees without allowing the "mind" to form any guesses concerning the reasons for these observed phenomena. Bacon's disrespect for the "mind" and its theories and hypotheses was probably caused by the part which the "mind" had played in the science of his time, which consisted mostly of hasty guesses, based on most inadequate observations, of theories accepted after one or two experiments, of reasoning from authoritative sources rather than of observation of the phenomena in question. It is on account of his strong revulsion against this non-observational and non-experimental science that Bacon went collection-mad, and wished to discover everything by tabulation of observations. He had seen much of the evil of prejudices, presuppositions, and hasty conclusions; he charged these to the "mind," and therefore he proposed to allow the phenomena to arrange and group themselves, without giving the "mind" any chance to exert its baleful influence. He was protesting against a science which was constructed

without any foundation of observed phenomena, and with the extravagance of all reformers he was not content to seek a broader foundation of observations on which to base and by which to prove these mental constructs, but attempted to get along with nothing except the observed phenomena; and this attempt, as we shall see, was a failure.

For the contention of Bacon is that if you collect enough instances and put them together correctly, their "nature" or the principle which explains them will simply emerge, that if you make a systematic tabulation of facts you will learn all that is to be known about them. He gives examples of long tables, which are models for all investigations of nature, and which present all the examples known to science or popular observation which come within this general field. For example, in the study of heat, Bacon collects in tables all possible examples of the presence, absence, increase, or decrease of heat, without any principle of selection whatsoever.

But the interesting thing for a study of the hypothesis is that, after he has made these elaborate tables, Bacon turns to what he calls the Interpretation of Nature in the Affirmative, without recognizing in the least that he is deserting his principle of mere tabulation of facts and is introducing an entirely new element, namely, an explanation of these facts. To state the matter in his own words:

Since Truth emerges more quickly from error than from confusion, we think it useful to grant permission to the Intellect, after having composed and weighed three such *Tables of First Presentation* as we have made, to gird itself up and attempt the *Interpretation of Nature* in the Affirmative, both from the Instances in the Tables, and from those which occur elsewhere.¹

This Interpretation of Nature is really an organization of the facts which brings order out of confusion, which enables him to select those examples from his table which have a bearing on the explanation and to reject those which do not, which helps the investigation by exercising this selecting and organizing power even though in itself it should be a false interpretation, which must be formed by the mind before any of his methods of testing truth can be applied; in short, it has all the marks of a working hypothesis although it is not called by that name. In making the tables the scientist had been a mere passive spectator but now he is an active constructor.

This shows plainly that Bacon has not succeeded in his attempt to gain knowledge by the collection of observations alone, without the addition of hypotheses. Until he introduces hypotheses he has only tables

¹ Bacon, *Novum Organon*, Book II, sec. 20.

of observations, without any principle of selection, of organization, or any kind of explanation. These tabulations and collections cannot be the knowledge he is seeking. Surely it is clear, then, that if knowledge cannot come from a collection of phenomena as they are merely perceived by the senses, unless these have been explained and interpreted by thought, that is to say, unless some hypotheses have been introduced, then these explanations, interpretations or hypotheses cannot be the work of that purely subjective "mind" which Bacon was so eager to exclude from science.

There is a well-known passage in the *Novum Organon* which shows that Bacon did at times explicitly recognize the value of active constructive thought. He says:

They who have handled the Sciences have been either Empirics or Dogmatists: the latter, like Spiders, spin webs out of themselves: but the course of the Bee lies midway; she gathers materials from the flowers of the garden and the field; and then by her own power turns and digests them. Nor is the true labour of Philosophy unlike hers; it does not depend entirely or even chiefly on the strength of the mind, nor does it store up in memory the materials provided by Natural History and Mechanical Experiments unaltered, but changes and digests them by the intellect.

This shows that Bacon departed at times in theory as well as in practice from his conviction that knowledge must be elicited entirely from things without any abstract useless generalities added by the "mind."

Descartes, on the other hand, belongs to the second group because his dominant desire is for knowledge that is certain, unquestionable, and necessary. He looks out over the whole field of knowledge, and finds there nothing but doubts, errors, presuppositions, and constant disagreements between learned scholars. He finds no single thing which is not the subject of dispute, save only in mathematics, where, to be sure, there is some firm and solid foundation. Therefore, he believes that the great task of thought is to find some basis of indisputable truth, some knowledge which is not the subject of conflict but is indubitably certain. For the sake of obtaining this certainty, he attempts to deduce all knowledge from simple truths which are intuitively and therefore unquestionably known, to construct a complete system of knowledge, proceeding uniformly from the simple to the complex, and therefore admitting no interference from particular investigations or limitations of inquiry. But, besides this interest in establishing an unquestionable certainty, Descartes has also an interest in solving particular problems and in performing scientific experiments. It is this latter interest

which explains the constant appearance, in his method of rightly conducting the reason, of those "questions" which limit the inquiry, which select significant points rather than construct a complete system. These "questions" are simply introduced into his treatise, without any sign that he recognizes the fact that in many passages he has declared that any limitations of this systematic and deductive procedure made in the interests of special investigations, any exclusive attention to certain aspects as more significant for some particular problem, is sure to vitiate our thinking.

Descartes thus represents two contradictory positions, one that knowledge should be obtained by the strictly deductive procedure of the reason, advancing from certain simple intuitively known truths to more complex truths, without any limitation by special investigations or any guidance from interest in definite problems; the other position, that knowledge should be obtained by striving to answer definite "questions," and by conducting special experiments fitted to answer them. He makes little use of the word "hypothesis," but it is plain that the former position is entirely inconsistent with any use of hypotheses and that the latter proceeds throughout by employing them.

To take up the contrasts of these two positions in more detail:

a) The one point of view maintains that we should seek truth in general, not the answers to particular questions, that we should seek truth for its own sake and should never entertain any particular purposes or ends for which this truth might be used. He believes this because:

There is nothing more prone to turn us aside from the correct way of seeking out truth than this directing of our inquiries, not towards their general end, but towards certain special investigations. . . . For example take our investigations of these sciences conducive to the conveniences of life or which yield that pleasure which is found in the contemplation of truth, practically the only joy in life that is complete and untroubled with any pain. There we may indeed expect to receive the legitimate fruits of scientific inquiry; but if, in the course of our study, we think of them, they frequently cause us to omit many facts which are necessary to the understanding of other matters, because they seem to be either of slight value or of little interest.¹

Now it is true that a short-sighted devotion even to such worthy ends as the promotion of the comforts of life or the joys of knowledge might tempt one to omit something whose value was not perfectly apparent, but which was nevertheless necessary to the understanding of the matter investigated. But it seems a rather drastic measure to

¹ *Rules for Direction of the Mind*, Rule I.

avoid such omissions by resolving to omit absolutely nothing, to urge that because too narrow limitation of inquiry may cause unwise omission, there should be absolutely no limitations to any inquiry. Nevertheless this is the solution which Descartes proposes, that there shall be no limitation of inquiry, no omission of any subject, regardless of the fact that this imposes a Herculean task upon the investigator.

The other point of view demands that very limitation and direction of thought which the former rejected. It maintains that knowledge consists of simple propositions and "questions," which guide our attention to "something of which we are ignorant" and "determine us to investigate it rather than anything else."¹ When he is discussing these "questions," Descartes forgets entirely his fears lest interest in a special investigation will lead to the omission of necessary facts, and takes delight in this very possibility of omitting all that is irrelevant to the problem. He says:

Thus, to illustrate, after we have limited ourselves to the consideration of this or that set of experiments merely relative to the magnet, there is no difficulty in dismissing from view all other aspects of the case.²

And again, he emphasizes this same use of the "question" when he writes:

However, though in every "question" something must be unknown, otherwise there is no need to raise it, we should nevertheless so define this unknown element by means of specific conditions that we shall be determined towards the investigation of one thing rather than another.³

Descartes makes no attempt to reconcile these two views, although the one considers the power of the hypothesis to limit investigation to be fatal to true knowledge, while the other considers this limitation to be absolutely necessary to knowledge.

b) The former view holds that knowledge is passive contemplation, gained by mere careful scrutiny of the facts, not by active manipulation of them. "Science in its entirety is true and evident cognition."⁴ But the latter view does not limit men to passive observation but allows them to deal actively with a "question," to "free it of every conception superfluous to its meaning,"⁵ to "split it up into various sections beyond which analysis cannot go in minuteness."⁶

c) The one view holds that we learn the relation of a number of facts by merely looking at these facts until we grow so familiar with them

¹ *Rules for Direction of the Mind*, Rule XIII.

² *Ibid.*

⁴ *Ibid.*, Rule II.

³ *Ibid.*

⁵ *Ibid.*, Rule XIII.

⁶ *Ibid.*

that the mind grasps their connection in one single effort. This view is most clearly stated in Descartes' eleventh rule for the direction of the mind, which reads:

If, after we have recognized intuitively a number of simple truths, we wish to draw any inference from them, it is useful to run them over in a continuous and uninterrupted act of thought, to reflect upon their relations to one another, and to grasp together distinctly a number of these propositions so far as is possible at the same time.

Descartes uses for an example of this the case of one who has recognized intuitively the relation of *A* to *B* and of *B* to *C*, and of *C* to *D*. He then points out that these recognitions do not necessarily lead him to see the relation of *A* to *D*, and that he can only make out this relation by remembering all the other relations. From which he makes this surprising deduction:

What I have to do is to run over them all repeatedly in my mind, until I pass so quickly from the first to the last that practically no step is left to the memory, and I seem to view the whole all at the same time.¹

The other view does not rely on this mere repetition, where the conclusion is carried by familiarity and rapidity of association, but holds rather that where we have recognized intuitively a number of simple truths and wish to draw an inference from them, we examine carefully all the relations to see whether they do or do not bear on the desired inference, set aside those which do not, and retain those which do bear upon it, and thus draw our conclusion. Using Descartes' own example, to illustrate this different view of his, the thinker does not go over the series of relations of *A* to *B*, of *B* to *C*, of *C* to *D*, merely to increase his speed until he can pass in one leap from *A* to *D*, but instead he has come in some way to desire to know the relation of *A* to *D*, and therefore goes over the series looking at each member solely from the standpoint of its connection with this problem of *A*'s relation to *D*. Thus when he wishes to make an inference he does not go over all his certain knowledge for the purpose of putting it all together in one act of thought, but instead he attends only to those elements of that certain knowledge which may bear upon the question he desires to answer. This is expressed by Descartes in the following extract:

Here therefore we maintain that what is worth while doing is simply this—to explore in an orderly way all the data furnished by the proposition, to set aside everything which we see is clearly immaterial, to retain what is necessarily bound up with the problem, and to reserve what is doubtful for a more careful examination.²

¹ *Ibid.*, Rule XI.

² *Ibid.*, Rule XIII.

Now this view demands a hypothesis as clearly as the former view excludes it, because it is only a hypothesis which can enable us to exclude what is immaterial and retain what is bound up with the problem, which can "determine us" toward the investigation of "one thing rather than another."

d) The first of these views holds that the whole task of acquiring knowledge must be performed by one man, who must accept absolutely nothing from other thinkers, but work everything out for himself, in order that his knowledge may not contain any untested presuppositions, or any assumptions adopted solely because of the authority of tradition. But the second view, which holds that knowledge is obtained by answering definite questions, contends that it is impossible for one man to perform all the detailed experiments necessary to the growth of knowledge, and that there is need for many men to join together in investigation, for one to begin where the other left off, and for each to limit himself to a few particular problems. Thus Descartes says:

But, having the intention of devoting all my life to the investigation of a knowledge which is so essential, and having discovered a path which appears to me to be of such a nature that we must by its means infallibly reach our end if we pursue it, unless, indeed, we are prevented by the shortness of life or by lack of experience, I judged that there was no better provision against those two impediments than faithfully to communicate to the public the little which I should myself have discovered, and to beg all well-inclined persons to proceed further by contributing, each one according to his own inclination and ability, to the experiments which must be made, and then to communicate to the public all the things which they might discover, in order that the last should commence where the preceding had left off; and thus, by joining together the lives and labours of many, we should collectively proceed much further than any one in particular could succeed in doing.¹

These contradictions arose from the fact that Descartes had in mind two different kinds of thought, aiming at two different ends: one at solving problems and making investigations, and the other at establishing a general unquestionable certainty. He was principally interested in obtaining general certainty, since he was obsessed by a dread of universal skepticism and was hunting a barrier against that. On this account he followed the same method which was used by men desiring religious certainty, that is, he took refuge in deduction and sought bases for that deduction which could be relied upon as given once for all, and never to be questioned. It would probably never have occurred to Descartes,

¹ *Discourse on the Method*, Part VI.

from his examination of thinking as it is actually done, that the proper method of thought was mathematical deduction from accepted and stable premises. But he was guided in his investigation by the specific purpose of finding some unquestionable certainty, and this appealed to him as the only way to find it.

But Descartes was also interested in the solution of problems and the conduct of experiments and investigations, and the characteristics of thought which his observations of actual cases of investigation revealed to him were not the same as those which followed from his effort to establish this deductive certainty. When he examined the strictly deductive thought he perceived that it started from certain given and unquestioned bases, proceeded to deduce all the facts and relations which followed from them, and sought above all things to obtain a consistent system; whereas, when he examined the way men conducted experiments and solved problems, he discovered that they started from one limited and specific inquiry, selected facts which were pertinent and rejected those which were not, and sought above all things to solve that particular problem. The purpose of establishing certainty demanded that the thinker add nothing and change nothing but passively receive what followed from these stable principles; whereas the study of actual experiments convinced him that the thinker must actively manipulate his material. Certainty is decreased by a large number of men each performing part of a deductive proof, whereas complicated specific problems require the co-operation of many men. Thought which proposes to establish certainty *überhaupt* will not use hypotheses because they have no place in its step-by-step process, and also because they express an active limitation of the inquiry and a selection of material which would not be the same for every individual, whereas certainty is established by a passive perception of relations which would be exactly the same for every rational human being. But thought which proposes to solve particular problems will use hypotheses, just because they do limit the problem, do direct attention to important phenomena, and do allow for active manipulation of the material. That ideal of knowledge as something complete, finished, and deductively certain always causes a perfectly natural distrust of hypotheses, because finished and perfect systems cannot be built up in that way. Nevertheless, the characteristics of thought which that ideal of knowledge forced upon Descartes were not satisfactory to him as an account of the thinking which he actually did, and he continually added characteristics which could account for his actual experience of thought and investigation.

Thus we see that two logicians who started with radically different motives for excluding the hypothesis and created absolutely different systems of logic were both alike forced to admit the hypothesis under another name before they could give accounts of the thinking process which satisfied them. We will now take certain other logicians in whom one or the other of these two motives was dominant in raising objections to the hypothesis and see if they were any more successful in getting along without any hypothetical or tentative idea.

CHAPTER II

THOSE LOGICIANS WHO REJECT HYPOTHESES BECAUSE THEY WISH TO DERIVE THEIR KNOWLEDGE DIRECTLY FROM THINGS

We have seen that Bacon wished to derive his knowledge directly from things themselves in order that he might escape the prejudices of the mind, the idols of the tribe, the cave, the market-place, and the theater. He felt that the only way in which he could ever obtain truth was by shutting out all the premature judgments and guesses of the "mind" and facing the facts squarely. Mill shared with Bacon this desire to rid himself of the fictions of the imagination, to get all his information from things; but with Mill this was complicated by a social motive.¹ He dreaded to let the mind play any active part lest it bring in some of those fixed preconceptions which he knew were closely connected with aristocratic privilege. With Locke the social motive was the sole cause for the attempt to obtain all knowledge from ideas which were given, fixed and complete, to an external mind.

Locke and Mill did not necessarily identify the hypothesis with those fixed and a priori principles or those innate ideas which justified the religious and political *status quo*, which were identified with those moral, political, or religious standards that were in vogue when these particular changeless ideas originated. But they believed that these fixed principles are found in the "mind," that they are the specific contribution which the "mind" makes to knowledge, and the only way they knew to avoid them was to show that no active participation on the part of the "mind" is necessary to knowledge, but that knowledge arises from the effect of wholly "objective" things on a completely passive mind. Thus they were led to reject the hypothesis because of its "mental" character, because they did not wish to admit any contributions whatsoever from the "mind," and they classed hypotheses among such contributions.

Thus Locke's attack on the innate ideas which had flourished in the Cartesian doctrine and also in the teaching of the English Platonists was motivated by his opposition to authority and conservatism in religion and in politics. He felt convinced that one of the strongholds of author-

¹ The term "social" is here used for convenience to include theological, political, and moral.

ity and conservatism was the innate idea, because that is bound to be fixed and stable and to resist change. Innate moral principles supported in any system are sure to be the principles which were held when that system was first formed; innate political principles are sure to uphold the kind of government which was in power when the system in question originated. Therefore, in the interest of freedom, Locke set himself to prove that there were no ideas which had been present in the mind from the beginning, and that the whole of human knowledge could be accounted for without the assistance of any innate principles. To make sure that the mind did not need to contribute any innate ideas, he showed that it remained entirely passive in the first process of obtaining knowledge, that it was absolutely blank, a white paper upon which nothing at all was written until the inner and outer senses made their marks upon it in the form of simple ideas. For, although rejecting the innate principles of Descartes, Locke retained in full force his separation between the "mind" and the world.

Now since the "mind" was not to be allowed to have any active part in the reception of these ideas, since it might not criticize them or manipulate them, and since they came from an entirely external world, they had to be given, complete, fixed, and unambiguous. That destroys all possibility of a hypothesis, because whenever you make a hypothesis you do so just because the simple ideas given you by your senses are not fixed and complete, but contain some ambiguity, some question. In order that you may deal with that ambiguity, answer that question, you hold an idea in suspense, entertain it experimentally, in other words, as a hypothesis. It is when the report you receive from your senses is not unambiguous, when you are not sure whether it is a speck on your telescope, a defect in your eyeball, or a new planet, that you make hypotheses to aid in your investigation. When there is no ambiguity you simply accept the fact and go on to some real problem.

But there are other objections to this position that all our simple ideas are given, complete and unambiguous, besides this one, that it fails to account for hypotheses. It also makes all reflection unnecessary, because, if it is possible to open your eyes and receive perfectly adequate and complete truth, why should you ever do any reflective thinking? Also this theory is powerless to account for any errors or mistakes at all, unless it is willing to call in question the possibility that any of these simple ideas can be valid. For these ideas all come to the mind ready made and finished, with exactly the same stamp of validity upon them, so that if it is possible to doubt that one of them is really true, it is

equally possible to doubt that any of them are really true. But since the mind has been declared completely passive in its reception of these ideas it cannot do anything to test them; since the mind has been absolutely separated from the objective world, it cannot in any way get into closer connection with the sources of these ideas so that it can solve the question of their validity; and therefore, if this question once arises, it becomes an insoluble one.

Locke realized that he could not admit any doubt concerning the truth of his simple ideas into his system, that he could not afford to explain any of the mistakes and errors which arise in human knowledge by alleging a lack of conformity between the simple ideas and the external facts. Therefore he asserts that since the mind cannot in the least control these simple ideas, make new ones, destroy those which it has received, nor alter those which it is sure to receive if it attends to an external object, these ideas are the effects of the powers of the external objects, ordained by God to produce those ideas in us. Hence these simple ideas must all agree perfectly with the reality of those objects.

Therefore, the simple ideas cannot account for any use of the hypothesis, any reflective thinking or inquiry, or any possibility of error. But any hope that a more adequate account of these can be given in connection with those complex ideas which are the voluntary acts of the mind is destroyed almost as soon as we find out what these complex ideas are. For the only complex ideas which have anything at all to do with the external world are those of substance, and if they are to be true, then they must be united by the mind in exactly the same way in which they were united in nature. But this is to state our problem of reflective thinking and of error in just the same insoluble terms in which they were stated in the case of the simple idea; the necessity is for an exact copy of completely external objects; there is no excuse for, and no possible motive for, anything except the most passive following of the pattern set; and if the problem is made to consist in how any mental construction can conform to this external pattern that problem becomes at once insoluble. The other complex ideas are no better fitted to explain reflection, hypothesis, and error, because they have nothing at all to do with the external world; they are merely "voluntary collections of simple ideas, which the mind puts together without reference to any real archetypes, or standing patterns existing anywhere."¹ To make all our problems and inquiries, all our reflective thinking, all our real mental activity, concern ideas which have no reference to anything

¹ Locke, *Essay Concerning Human Understanding*, Book II, chap. xxxi, sec. 3.

in the world, which are wholly mental constructions, is to make thinking such a useless luxury that no sensible person would ever care to indulge in it. Yet that this is the position to which Locke was driven at times by his theory of the genesis of knowledge, by his insistence on giving the mind certain fixed and unambiguous ideas to start with, is proved by such statements as the following:

Since the mind, in all its thoughts and reasonings, *hath no other immediate object but its own ideas*, which it alone does or can contemplate, it is evident that our knowledge is only conversant about them. . . . Knowledge, then, seems to me to be nothing but the perception of the connexion and agreement, or disagreement and repugnancy of any of our ideas.¹

This trouble began when Locke separated the mind from the world so completely that no idea in this exclusive mental world could be compared with any fact in the equally exclusive physical world, and then asserted that the mind received from this physical world perfectly fixed and given mental ideas which it then proceeded to combine in the form of complex ideas. That made hypotheses impossible, because a hypothesis demands some connection between ideas and real things; it must be a tentative plan made to assist in dealing with the real world. Now simple ideas are not, according to Locke, in any sense constructed, and therefore they can have no hypothetical or tentative element, but are given complete and fixed. Complex ideas of substance are untrue just as they are made by the mind, and true only so far as they are received from an external nature; therefore they cannot assume the rôle of hypotheses. Other complex ideas are made by the mind but have nothing at all to do with external reality, and therefore they cannot account for hypotheses. But Locke's account not only made hypotheses impossible, it also made it impossible to account for both truth and error, made it necessary to assume a miraculous correspondence between ideas and the world, since no other correspondence was explicable, and made it impossible to find any use for reflective thinking or any knowledge which was more than mere juggling with wholly subjective ideas.

John Stuart Mill's social motive was exactly the same as Locke's, namely to escape the social consequences of given, innate, a priori ideas. He felt, as Locke did, that these inevitably came to be identified with the existing social order, that they were the greatest bulwarks of aristocratic privilege, that they were the constant opponents of a democratic order. He wished to make room in his theory of knowledge for growth and

¹ Locke, *Essay Concerning Human Understanding*, Book IV, chap. i, secs. 1 and 2 (italics mine).

experiment and change, in order that there might be room in his theory of government for development and freedom. Now how could he free thought from its dependence on certain fixed, innate principles which it brings to experience and which it forces upon all the concrete material of perception? At first Mill felt that this was to be done in much the same way that Locke had done it—by refusing to allow the “mind” to bring anything to perception, by refusing to allow it to play any active part in thinking, by keeping it merely receptive.

This is the secret of Mill’s intermittent fear of the activity of the mind, and of his conviction that, if he can only get rid of the presuppositions and fancies of that mind and get face to face with things, truth will appear. He objects to hypotheses because they mark the intervention of the “mind,” which is likely to bring in error and prejudice and authority and precedent. For discovery of truth no hypotheses, no precedents, no mental constructs are necessary: it is possible to progress from one particular straight to another particular. Things themselves, just as they are given, contain all the information necessary, and by careful and minute observation of these things you may discover the conceptions or theories which are *within* them. In Mill’s own words:

The conceptions, then, which we employ for the colligation and methodization of facts, do not develop themselves from within, but are impressed upon the mind from without.¹

And again he says:

The conception by which the mind arranges and gives unity to phenomena is not furnished *by* the mind until it has been furnished *to* the mind; and the facts which supply it are sometimes extraneous facts, but more often the very facts which we are attempting to arrange by it.²

That is, it is not necessary to make any suppositions or guesses; we must simply examine carefully the objective phenomena, compare them minutely, and abstract the general conceptions which reside within them.

In those parts of his logic which purport to do without hypotheses altogether, Mill’s examples proceed by a cumbrous collecting process which would not have been necessary if the hypothesis were freely used; nevertheless, they all show some evidences of a hypothetical method which steals in against his will. One such example is found in his account of the arrangement and classification of a large number of objects.³ He asserts that he accomplishes this task by taking one of the objects

¹ *Logic*, Book IV, chap. ii, sec. 2.

² *Ibid.*, sec. 3.

³ *Ibid.*

as a standard and comparing it with all the rest, taken one at a time. This does at first sound like a perfectly objective process in which the objects furnish their own classification and no thoughts or ideas are needed. But upon more careful examination, we find that he admits that in every case there must always be one judgment, namely, that two objects agree enough to be put in the same class, and that, therefore, this class is not presented by the objects themselves but is constructed in dealing with those objects. Besides this one constructive activity which Mill considers always necessary, there are two others which he admits at times, without which this process of classification is exceedingly toilsome; these are, first, the choice of the object to be taken as a standard on the basis of which one of the objects in question "offers in a peculiarly striking manner some important character" and will therefore make a good standard, and secondly, the decision that some of the circumstances of the first general conception are unimportant and can be omitted. So, even in his own example, Mill fails to show that conceptions come from the objects themselves, without any active construction, without the use of any ideas or hypotheses.

Another of Mill's examples to prove that conceptions "are furnished to the mind" is Kepler's discovery of the elliptic orbit of the planet Mars.¹ Mill says that in the actual discovery Kepler did have to bring the general conception of an ellipse which was already in his mind to the phenomena, but that this necessity was due entirely to the invisibility of the orbit. If Kepler had been able to see the orbit, he could have obtained his general conception of an ellipse just as well from that phenomenon as from those objects from which he did obtain it before he applied it to the orbit of Mars. Therefore, it is merely the accident of the invisibility of the paths which made it impossible to follow the ordinary procedure and get the organizing general conception from the phenomena which were to be organized.

Now Mill is perfectly justified in pointing out here that the concept of the ellipse was originally derived in connection with objects, that it was not made up *de novo* by the isolated activity of the mind and then applied to the observed phenomena, and that in almost every case, the general conception which is used to explain certain phenomena might have been derived from those phenomena themselves. But what he does not recognize is the fact that it was only because Kepler had formed an idea of the ellipse from observing it among other simpler or better-known phenomena that it was any help to him in forming a general

¹ *Logic*, Book IV, chap. i, sec. 2.

conception of the path of the planet. If he had known nothing about ellipses except that the planet Mars described one, then the concept ellipse would not have helped him to simplify the relations of the orbit; for the way in which a general conception organizes and simplifies relations is by putting them in a form which is more familiar and more easily handled. It is true, as Mill says, that "every conception which can be made the instrument for connecting a set of facts might have been originally *evolved* from those very facts." But even so, it has to be *evolved*; if it were but a condensed statement of the facts right before the eyes of the investigator, then it would not be of use in connecting and organizing those facts.

In this example Mill really has made out a very good case against any thinker who supposes that general conceptions are furnished by the "mind" alone out of all connection with objects, that "in comparing things with each other and taking note of their agreement we merely recognize as realized in the outer world something that we already had in our minds." But in drawing his conclusions he asserts too much. He is not content to disprove the theory that the mind forces its *independently* fabricated conceptions upon a world of passive phenomena, and to assert that these conceptions are the products of the interaction and co-operation of the mind and the phenomena; but he goes on to assert what his example cannot prove, that the wholly independent objects force these conceptions upon a passive mind.

Another thing Mill does not account for in his statement that the facts themselves impress the conceptions upon a waiting mind, and that no hypothesis or mental activity is needed, is that the facts are so manifold, so many sided, that they will be a mere chaos, unless there is an active mind which focuses its attention on one phase of the situation. Without some hypothesis to focus its attention thus, without some purpose to guide it, a merely passive mind might stare endlessly at the facts without reaching any conclusion. To take this example of Mill's, Kepler might have stared at the planet Mars for years, he might have recorded and tabulated thousands of facts about it, and yet never have formed any general conception of its path, if he had not actively selected those facts which could help him to form such a conception, and had not excluded all others. The hypothesis that there was a regular path, the tentative hypotheses concerning the possible paths, and the comparison of Tycho Brahe's observations with these successive hypotheses made possible an explanation and organization of what would otherwise have been mere scattered observations on all possible aspects of the

situation. The phenomena themselves will never do this work of selection.

A very simple example taken from a judicial investigation, which Mill gives as a case of induction without hypothesis, well illustrates this need of ideas or hypotheses in selecting and organizing observations. He says here:

We can ascertain whether a man was murdered or died a natural death, from the indications exhibited by the corpse, the presence or absence of signs of struggling on the ground or on the adjacent objects, the marks of blood, the footsteps of the supposed murderers, and so on, proceeding throughout on uniformities ascertained by a perfect induction without any mixture of hypothesis.¹

But here he has already represented two rival hypotheses, one that the man died a natural death and the other that he was murdered, and it is only in relation to these hypotheses that the facts mentioned were selected. There was an infinite number of other facts, from the color of the man's hair to the variety of tree under which he was found, and it is only the presence of the hypothesis or idea of murder which selects the footsteps on the ground as the important phenomena. Without that hypothesis they would be no more likely to be noticed than the size and color of the flowers which grew beside his dead body.

Besides the fact that Mill's own examples of induction, selected for that very purpose, do not succeed in eliminating hypotheses, there is another strong objection to his contention that the facts themselves give us our knowledge, without any hypotheses added by the mind, that the organizing and systematizing conceptions of science are impressed upon the mind from without, not formed by the activity of the mind as it works with phenomena. That objection is that on this supposition we are left with no explanation for error, for mistaken conceptions, for false theories. In these actual examples which Mill gives it is possible to account for the errors which arise just because he has not succeeded in excluding hypotheses. For instance, in the classification of objects it is easy to decide that two objects are enough alike to be classed together, when their resemblances are only superficial. Then the conception formed by an examination of the respects in which they were alike would be worthless and false. In the judicial investigation or in the geological inquiry, the true cause might be something absolutely different from the hypothesis formed. Then the fact that the hypotheses held always determine the data selected might cause a neglect of those facts which

¹ *Logic*, Book III, chap. xiv, sec. 7.

point to the correct cause and thus lead to a false opinion. But if Mill should succeed in eliminating hypotheses he would be left without any explanation of the errors which arise. If the mind were entirely passive and merely allowed the facts to impress conceptions, principles, theories, upon its receptive surface, all of these donations of the facts would have to be absolutely true. We know that our knowledge is never absolutely free from error, but there would be no way to account for its presence unless we endowed the objective facts with a spirit of perversity and wilfulness, in addition to their already heavy endowment of selective ability and power to organize themselves.

We have seen that, even in that part of his logic where Mill is claiming to proceed entirely without hypotheses and to receive his explanations of phenomena from the conceptions which these phenomena impress upon the mind, he is after all making use of hypotheses. There are other parts of his logic where he recognizes the use he makes of these hypotheses; parts where he compromises by calling them a convenience, an aid to investigation, which can, however, be carried on without their help by the collection and observation of all the facts; and still other parts where he asserts that the hypothesis is not only useful but also necessary to investigation, to the discovery of truth.

Mill's first step in the recognition of the place of hypotheses in investigation is made without changing his conception of the nature of the hypothesis, which remains an independent creation of the "mind," a supposition or guess which is either without any actual evidence, or else is made "on evidence avowedly insufficient." But although these hypotheses are mere suppositions and guesses, although they are invented by the "mind," Mill still considers them useful, and useful in three ways. In the first place they enable "the imagination to represent to itself an obscure phenomenon in a familiar light." In order that it may do this the hypothesis must contain some well-known fact, because some part of it must be already familiar, or how could it render the obscure phenomenon more familiar? The second use of the hypothesis is that it is possible to make a certain supposition, deduce its results in accordance with known principles, and then compare these deduced results with the observed phenomena, and in that way verify this supposition, and establish it as the actual cause of the phenomena. It must be remembered that this is considered merely a convenience by Mill, it is not the only way in which the cause may be discovered, in fact it is not a safe way unless the verification is such as to exclude the possibility of a false law leading to true results. But it is a shorter method than the one

without hypotheses because it enables one to do without the first step of the investigation process, the induction to ascertain the law of the causes, since this is assumed in the hypothesis rather than being proved by a complete induction. For example, it is possible to gather together all the facts about whales, and from the vast collection read out some generalization concerning them; but it is a shorter process to guess at this generalization and then see whether your observations are in harmony with the guess. This guess or supposition enables one to begin an investigation by assuming a possible cause, instead of by discovering this possible cause by the collection and analysis of numberless single instances. The third reason that he considers hypotheses useful is that they are convenient ways of manipulating phenomena, that they reduce to order a confused set of phenomena.

But in another part of his logic, Mill admits that the hypothesis is not only convenient and useful, but even absolutely necessary for the development of science as we have it, because "those unobvious, delicate, and often cumbrous and tedious processes of experiment, which have thrown most light upon the general constitution of nature, would hardly ever have been undertaken by the persons or at the time they were, unless it had seemed to depend on them whether some general doctrine or theory which had been suggested, but not yet proved, should be admitted or not." However, even here he attempts to save his position by asserting that "it is abstractedly possible that all the experiments which have been tried might have been produced by the mere desire to ascertain what would happen in certain circumstances, without any previous conjecture as to the result."¹

There are passages, however, where Mill admits without any such reservation the absolute necessity of hypotheses, and, what is more noteworthy, abandons entirely the theory that hypotheses are exclusively mental and shows them as arising from, and molded by, the objective world, and necessary because of their ability to modify that world. Here the absolute separation between mind and matter is transcended, the facts are no longer complete and fixed entities given to a passive mind, but are incomplete and partial, or else chaotic and confused complexes, with which an active mind must work to suggest those changes and modifications which are necessary to complete the partiality or to introduce order in the confusion.

This final step in Mill's recognition of the place of the hypothesis comes when he recognizes that the mind must deal actively with things,

¹ *Logic*, Book III, chap. xiv, sec. 5.

not only in order that it may know and understand these things, but also in order that it may use them in action, that the reason the mind seeks to know causes, to investigate hypotheses, to manipulate ideas, is not merely that it may see them more clearly and understand them more perfectly, but that it may through that organism with which it is one handle the objects in question more effectively, manipulate them more successfully, change conditions according to its purposes. That is, Mill points out that by mere observation we get one infinitely complex state of the universe followed by another as infinitely complex. These must be broken up and analyzed if we wish to find out "what consequents, in nature, are invariably connected with what antecedents." But he points out that this analysis must be both subjective and objective, must deal with objects as well as with ideas, in fact that the only purpose of the ideas is to show us how to deal with things. To state the matter in Mill's own words: "No mere contemplation of the phenomena, and partition of them by the intellect alone, will of itself accomplish the end we have now in view." To determine which consequent is invariably connected with an antecedent:

We must endeavor to effect a separation of the facts from one another, not in our minds only, but in nature. The mental analysis, however, must take place first. . . . The only object of the mental separation is to suggest the requisite physical separation, so that we may either accomplish it ourselves, or seek for it in nature; and we have done enough when we have carried the subdivision as far as the point at which we are able to see what observations or experiments we require.¹

One of the chief causes of Mill's greatness is his inconsistency. He is willing to state whatever he believes to be true, whether his systematic structure can account for it or not, and therefore he is able to escape the results of many of his prejudices. Thus, although he never really overcame the influence of the assumption that the mind is entirely subjective and that its theories are dangerous to truth, although he clung persistently to his hope that he could make a logic of things free from the taint of mental constructions, nevertheless, when he found in his analysis of actual investigations that ideas were really of help in solving problems, he was honest enough to record that fact. At first he was influenced by his prejudice against ideas as constructions of a purely subjective mind to attempt to save his position by the contention that these ideas, these hypothetical constructions, were humble conveniences, short-cuts to the truth, and that any knowledge that had

¹ *Ibid.*, chap. vii, sec. 1.

been obtained by their help required extra careful verification. This is the explanation of his second position. But later he was able to throw off all bondage to this prejudice against the "mind," and to recognize freely that ideas are not only subjective but also objective, that hypotheses are not only ways of arranging conceptions but also ways of arranging physical objects, that in fact the only reason we do work with ideas is that we can more conveniently manipulate them, discover their implications, change and modify them more easily, because as ideas they are freer and have fewer relations, and that later we may use the results of these processes in dealing with those objects which have existence for others as well as for ourselves.

Now if Mill had really recognized the force of this last view of the hypothesis it would have made over his whole logic. It would have necessitated his recognition that facts come to the mind, not fixed and unambiguous, but rather tentative and ambiguous, asking questions which require hypotheses to help answer them, incomplete, and needing hypotheses to suggest those manipulations which can complete them. It would have compelled him to transcend that separation between the "mind" and the world and thereby to overcome the prejudice against hypotheses as those conceptions which are added by the "mind" to external things. It would have necessitated the reconstruction of his ideal of knowledge so that its aim would have been not the beholding of a complete and finished whole, but the efficient manipulation of specific objects; as he puts it himself, "the only object of the mental separation is to suggest the requisite physical separation." But the old separation between the mind and the world is too firmly entrenched in Mill's thought to be evicted by this discovery concerning hypotheses, and his ideal of knowledge is too thoroughly one with that of the rationalists and idealists to be easily replaced by another. For, in spite of his empiricism, in spite of the fact that he wishes to obtain his knowledge directly from things alone, the kind of knowledge Mill desires is of principles which will enable him to predict the whole prior and future course of the universe from the events which lie before him; his ideal of the knowledge of the cause of a phenomenon is not that which will enable him to control the phenomenon either theoretically or practically, but is rather the sum total of all the antecedents of that phenomenon, the collection of all the circumstances, both positive and negative, which preceded it and without which it would not have happened, in other words, a summary of the whole prior state of the universe. Mill realized that such a complete knowledge could never be reached in any piecemeal hypothetical fashion and so this motive combined with his main motive to know by

means of things alone to prevent him from giving an adequate place to the hypothesis in his system, although he does give such a good account of it.

In Bacon, Locke, and Mill we have a group of logicians who reject the hypothesis, not because of their trust in deductive and mathematical systems, but because of their trust in their own powers of observation, not because they wished to deduce a system from mathematically absolute first principles, but because they wished to observe actual things without prejudice. They felt a strong objection to the hypothesis because they thought it had an inevitable tendency to make them judge the case before the evidence was all in, to tempt them to assert the theory without examining all the facts, and they were sure that any such bias and prejudgment was sure to be in the interests of the dominant party, to be derived from the religious, political, and moral traditions of the past and to plant itself in firm opposition to any change and progress. It seems strange to find tentative and experimental ideas rejected from this motive, but we must remember that they were rejected as "mental," as creations of that "mind" which was the guardian of innate principles and traditional teachings, and not as specifically experimental and hypothetical. They were so afraid that the "mind" would prejudice the case that they attempted to put the "mind" out of court altogether; they were so afraid of old foggy ideas that they refused to have anything to do with any ideas whatsoever. They tried to show that thinking can be done entirely in terms of things, that conclusions can be reached by the collection of enough instances, that the phenomena themselves give to the passive mind all of its conceptions, classifications, and ideas.

So long as they insisted on rejecting the hypothesis they could not give an adequate account of the thinking which actually went on, they had to content themselves with mere collections of phenomena with no principle of selection or arrangement, or else with the shuffling and comparison of purely subjective ideas. But on the other hand they could not admit hypotheses without making radical changes in their whole systems of thought, without denying that separation between the "mind" and things which they all so firmly believed in, and without, in the case of Locke and Mill at least, changing their ideal of knowledge as something complete and finished to be beheld, not to be worked with. So they were forced either to reduce knowing to a mere conjunction or disjunction of subjective ideas as Locke did, or else to make practical use of hypotheses because they could not account for thought without them, but to refuse them a place in their logical systems because it was too destructive to those systems to admit them.

CHAPTER III

THOSE LOGICIANS WHO REJECT HYPOTHESES BECAUSE THEY DESIRE A COMPLETE AND FINISHED SYSTEM OF THOUGHT WHICH PROCEEDS BY STRICT NECESSITY

This second group of logicians is made up of those thinkers who desire most of all to obtain certainty and universality, who are above all eager to establish a well-authenticated system of knowledge. Most of them have been greatly influenced by the method of mathematics and all of them feel that if they can only obtain knowledge which has been derived by strict deduction from unquestionable premises, they will have something which can withstand all the assaults of doubt and criticism. The characteristic which marks all of these thinkers is their passion for completeness and for indubitable certainty and their conviction that this can be attained only by some strictly deductive process. All of the members of this group agree that the ideal of knowledge is a conception of a universal order which comprehends the whole world, is an ideal of a complete systematic whole from which no smallest circumstance is lost or omitted. None of the rest, with the possible exception of Holt, are as naïve as Descartes in the assertion that the only way to obtain such knowledge is by deduction from unquestionable premises; for just as the other group of logicians, whose main motive was to obtain knowledge straight from real objects in order that it might apply to the actual world, also had as their ideal this same kind of complete and necessary knowledge, so these logicians have a subordinate but still strong desire to have their knowledge apply to reality, to be in contact with actual objects. They employ, therefore, various devices to avoid the usual barrenness of deduction which continually appears to be unable to obtain more than a restatement of that knowledge which was already within the premises. But in spite of this suspicion of deduction and the consequent attempts to introduce induction, to get something more than a rearrangement of the premises, they are none of them willing to admit information gained piecemeal by observation and experiment, because they realize that it can never give them the complete knowledge which they desire; they will not accept as part of their ideal of knowledge anything obtained by limited hypotheses and partial inquiries, because they know that these can never give a finished and unified system of truth.

To be sure they all admit the necessity for some kind of practical, everyday, working knowledge; they admit that we need finite and partial accounts of the world for our business and science; they admit that we must use "the impure and uncertain art which uses the false rule and the false circle . . . if any of us is ever to find his way home."¹ To this knowledge hypotheses may well belong; they help to limit the attention, select data, arrange methods of practical procedure. But in the ideal of knowledge, in the conception of a universal order comprehending the whole world, in the concrete universal revealing itself in its own differences, in the principles of order arranging the facts to which they apply with strict deductive powers, the particularity and partiality of the hypothesis cannot be other than a hindrance and an impertinence, and it is therefore denied any place at all in this complete knowledge which is their ideal.

If these logicians were able to make room in their complete systems, which proceed by strict necessity, for that kind of thought which does enable us to find our way home, which does show us how to mend bridges and prevent diseases, then we should have to admit that they have a right to abandon hypotheses. It is not that their logic ought to perform those actual tasks, that is the province of the special sciences; but it ought to give an account of a kind of thought that is able to perform them, not one that is powerless before them. If they cannot give such an account of thought, if they are forced to reject all practical accomplishments and scientific researches as too humble and unworthy to play any part in their complete system, then we have a right to urge that this system is inadequate. In trying to attain a thought which has a nobler mission than solving practical or scientific problems they have lost that thought which can make fruitful connection with facts.

Kant is a perfect example of the logician who cares so much for the indubitable certainty of knowledge that he is willing to reject hypotheses as lacking in these essential attributes of universality and necessity, even though this forces him to exclude from completely logical procedure the only type of thinking which he himself considers capable of solving specific problems. For Kant does contend that the hypothetical method is an absolute necessity in the solution of any specific problems, in any of our dealings with nature, in any of the investigations of chemistry, biology, geology, or astronomy, and that this is a necessity which springs not from the finitude and incompleteness of our knowledge, but from the nature of the problems themselves. Thus he says in his *Logic* that he

¹ Plato *Philebus* 62.

considers some kind of a "provisional plan" or "provisional judgment" indispensable to any inquiry, discovery, or invention, because it must be present to limit the field of inquiry, for "otherwise our thoughts go on at random."¹ At the close of the *Logic* he states even more definitely that the hypothesis is a fundamental necessity of some types of investigation and not merely a temporary makeshift due to our human weaknesses. He states: "There are sciences which permit no hypotheses; as, for example, mathematics and metaphysics. But in dealing with nature they are useful and indispensable."² Thus in spite of his predominant interest in the general conditions of all experience, which conditions he deduces a priori, Kant never forgets the fact that the specific problems of science cannot be solved by any application of this a priori and universal knowledge, but must be empirically and experimentally determined, and that for this process hypotheses are necessary.³

So far Kant seems to have a place for the hypothesis in his logic, but then, to our surprise, we find that, although he admits the indispensability of the hypothetical method in dealing with all specific problems, he nevertheless rejects this method entirely from true logical thinking. It is a necessity for science, a necessity for practical life, but it has no place in logic. A truly logical method must possess at every step universality and necessity and there is no universality or necessity in a hypothesis. For this reason we find Kant stating in the *Critique of Pure Reason*: "Everything looking like an hypothesis is contraband," and, "As regards certitude, I have fully convinced myself that, in the sphere of thought, opinion is perfectly inadmissible, and that everything which bears the least semblance of an hypothesis must be excluded as of no value in such discussions."⁴ Even in his *Dreams of a Spirit-Seer Illustrated by Dreams of Metaphysics*, Kant has a section which implies, though it does not explicitly state, the inferior position to which he relegated the hypothesis, in spite of its usefulness. He says:

All such opinions, as those concerning the manner in which the soul moves my body, or is related to other beings, now or in future, can never be anything more than fictions. And they are far from having even that value which fictions of science, called hypotheses, have.⁵

¹ Sec. 9.

² "Es gibt Wissenschaften, die keine Hypothesen erlauben; wie z.b. die Mathematik und Metaphysik. Aber in der Naturlehre sind sie nützlich und unentbehrlich" (*Logic*, sec. 10).

³ *Critique of Pure Reason*, sec. 26.

⁴ Preface, p. xxv (Max Müller Edition).

⁵ *Dreams of a Spirit-Seer*, Part II, chap. iii.

Kant's position concerning the hypothesis may be summarized thus: Hypotheses are absolutely necessary to the determination of special laws which can never be deduced from the categories, and are indispensable to those special inquiries and investigations which are found in such sciences as chemistry, physics, biology, and astronomy. Nevertheless, the hypothetical method can never give apodictic certainty but only probability. Logic, however, is limited by Kant to that which has universality and necessity. Therefore, the hypothetical method, though useful and even indispensable, has no rightful place in logical thinking.¹

Now what is the meaning of Kant's entire exclusion from the province of logic of that hypothetical method which he still considers necessary for science or for any understanding of specific objects and events? It is not in the least correct to state that Kant believes that special laws and special inquiries are wholly unrelated to, and wholly unaffected by, his logic, because Kant considers that all these special laws and special inquiries must be subject to the categories of logic though they cannot be completely derived from these categories. All particular investigations are therefore dependent on logic, inasmuch as the categories of logic determine the general conditions under which they can be carried on. According to Kant the only way in which we can ever know that a particular question, a specific problem, concerns anything objective, anything more than an affection of our own subjectivity, is that it can be grounded in these universal categories of logic; the only basis for the objectivity of the phenomena about which we frame our hypotheses is to be found in the a priori concepts of logic. We should have only bare impressions of sense, mere "judgments of perception," were it not for the guidance of the categories and the unifying activity of the conscious self. We can merely judge that one particular thing or event is perceived by us here and now as connected with some other particular thing or event, until we gain some logical basis which assures us of the possibility of an objective connection of these things or events independent of our perceptions. As Caird says:

Without synthesis the consciousness to which impressions of sense could give rise would be only a scattered and unconnected consciousness, and not

¹ There is the following suggestion in the *Logic*, sec. 9: "Such judgments, then, have their use, and there might even be given rules how to form provisional judgments." But it seems to me that this does not in the least imply that hypotheses are an integral part of a complete logic, but merely that some practical and empirical rules for the formation and testing of these useful instruments of investigation might well be included.

the consciousness of "Nature," as a system of permanent objects acting in definite ways on each other. In fact, they could give rise to no objective consciousness at all. On the other hand, Kant maintains that it is possible to explain that consciousness by the aid of a synthetic activity of mind, guided by the categories.¹

Thus Kant's logic is intimately connected with the solution of special problems by the hypothetical method, because that logic finds an explanation and a justification for the objectivity of the things and events with which these problems deal, a rational basis for that synthetic activity which alone makes possible the "systems of permanent objects acting in definite ways on each other" with which we must necessarily deal when we seek to solve specific problems. So for Kant the problem of logic is that of showing that there must be some a priori basis for our most fragmentary particular experiences, and that we cannot build up this a priori basis from our particular experiences because these a priori universals are conditions which are necessary to the occurrence of those particular experiences out of which they would be formed. Therefore, no specific investigations could be carried on, there would be no perceptions of an objective world which the subject could investigate, were it not for those universals which it is the task of Kant's logic to criticize and establish.

But although the universal laws of experience which are the material of logic thus give the necessary basis for any particular investigations, they can never of themselves afford a complete answer to these inquiries. As Kant states it in the *Critique of Pure Reason*: "Special laws, therefore, as they refer to phenomena which are empirically determined, cannot be completely derived from the categories, although they are all subject to them."² All specific problems must arise and must be solved according to these a priori conditions, but the solution of one of these specific problems can never be derived from these general conditions. For this determination of special laws, for this actual solution of particular problems, the hypothetical method is necessary, and yet this method, because it lacks universality and necessity, must always remain for Kant a logical weakness, must always lack the warrant of true logical procedure. The determination of special laws, the special investigations of science and of common sense, are then partly related to Kant's logic and partly excluded from it. They are related to it in so far as they receive from its concepts the basis for an objective world to which they can refer; they are excluded

¹ Edward Caird, *The Critical Philosophy of Immanuel Kant*, I, 349.

² Sec. 26.

from it in so far as they must necessarily be carried on by methods which lack universality, and are therefore never truly logical. This must not be understood as a mere statement that Kant's logic does not itself answer any specific problems of science or of everyday life. Such is not the province of logic. But Kant specifically rejects from logic the only method of thinking which he himself considers fitted to solve these problems. The result is that whenever the subject is dealing with a specific problem he must always proceed by a method which lacks all logical warrant, and is merely a psychological makeshift, even though it is granted to be an indispensable makeshift.

The spirit of Hegel's account of thought seems at first sight very favorable to procedure by hypothesis. Hegel attempts to prove that his categories are intrinsically related to their material by showing how they evolve, how they unroll themselves; he tries to show that they are merely progressive aspects of the actual objects as they come to be known, and are therefore intrinsic, not applied from without. The evolution of the categories is the inevitable result of an attempt to understand an actual object by bringing it entirely under one category, explaining it wholly by one formula, which attempt immediately calls attention to those opposite characteristics which cannot be thus accounted for, whereupon the reactionary attempt is made to explain this object by exclusive reference to this opposite category, that is, to the opposite aspect of the object. Finally the realization comes that a complete account must unite both aspects, and thus a third category arises, that is, a third form of understanding the object which includes both characteristics. So Hegel's categories are not external forms applied to the material from the outside, but are the aspects of the objects themselves, as they become progressively better known. Now so far in the account there is no reason why some of the categories might not well be tentative and hypothetical; in fact it seems quite reasonable that as the object comes to be better known certain aspects should appear first as hypothetical ideas which can be more easily manipulated than the object itself and which suggest criticisms and reconstructions of that object.

But unfortunately Hegel, too, was eager to construct a completed system, to have a completely realized rationality. He was so anxious to show that this rational order is not a mere ideal, not a mere ought-to-be or is-going-to-be, that he made it into an already realized world-order; he was not content to hold that it is realizable, that it is the work of that vital and fruitful connection between thinking and things which he posits, to realize this rationality, but instead he made it already completely

realized. There are two historical conditions which account for Hegel's desertion of his principle that an account of thought is an account of the progressive aspects of objective reality as it *comes to be rationalized* and his assertion in direct contradiction to this, that rationality *is already accomplished* as well as being accomplished, that a completely rationalized state of the objective world is eternally and timelessly realized. One is the state of science at that time. This was so fragmentary and so incomplete that it offered little encouragement to the belief that thought could actually criticize and reconstruct the objective world, and afforded much excuse for Hegel's complaint of the unwarranted postulates and hypothetical constructions of science and its lack of the form of necessity. There really is so much justification in the state of science for his lack of faith in the power of the individual's thought and investigation to rationalize reality, that it is probably much fairer to emphasize the faith Hegel did show in asserting that thought could deal vitally with the world—could rationalize it—rather than to put the stress upon the fact that he feared to let the realization of this rationalization by thought depend on those poor finite minds which were making such a failure of science, and let it rest instead on the eternal achievement of this rationality in the timeless Infinite. Probably in that state of science no philosopher could have dared to assert that the objective world is being progressively rationalized by the thinking of individuals, and the most any philosopher could do was to represent this rationality as realized in the world-order by means of an Absolute Thought. The other historical influence mentioned is found in the state of Germany at that time. For she was being torn by many individual principalities each struggling for power, she was suffering from a lack of any strong central system able to compel her individual princes to cease their destructive strife and co-operate with each other. This intense need for some strong system of government, a need which impelled the Germans to seek the strongest and most stable political system they could devise, must have influenced Hegel in his desire for a system which could be absolutely depended on, which was no shadowy ideal to be worked for and perhaps lost, but a completely realized reality. He had seen so much of uncertainty and incompleteness and individuality in the fields of science and politics, that his ideal became perfect a priori certainty, absolute and changeless completeness.

But this conviction that the objective world-order is completely rationalized, that the rational is the real, influences him to give an account of thought which makes it impossible for this thought to come

into that fruitful connection with the objective world which he has declared to exist. In the first place it makes him assert that the categories of thought are not something which the individual is working out in his progressive understanding of things, nor even something which the Absolute is working out, but are eternally realized and finished, completely fixed and changeless. It is this ideal of knowledge as already completely rationalized which prevents Hegel from realizing that there can be new categories, whereas otherwise he would surely have recognized that, since the categories are the forms which the objects take as they become better understood, therefore they will continually take new forms as men continue to investigate and inquire.

In the second place, this ideal of a complete and finished system makes Hegel attempt to manage his deduction of the categories by sheer intellectual necessity, not by the necessity of dealing with specific subject-matter which needs to be better understood. That this is the reason his deduction limps is indicated by the fact that it generally moves easily within the sets of three terms, where he almost always makes use of specific object-material to show how one category passes over into its Other, but breaks down where he passes from one triad to another, where he seldom makes use of any specific material but merely states that it is characteristic of thought to pass on to another category that is not yet complete because it has not yet attained the Notion. It is also in the interests of this complete system that he asserts that all the categories are finally taken up into one all-inclusive category. Heedless of the fact that he has taught us that it is the very nature of a category to be relative, that every attempt to work one category exclusively always causes it to pass over into its Other, he here introduces a category which is Absolute, which has no Other.

Thirdly, if the objective world is completely rationalized, if it does not depend upon our feeble finite efforts but is timelessly and eternally realized, then there can be no errors and there can also be no problems. For, since thought has been made the whole method of the world's progress, that thought cannot possibly fail, and therefore there can be no error. Since the rational is already the real, there is nothing still unrationalized from which problems can arise, there is no work left for thought to do for there is nothing unrationalized left for it to deal with. The work of thought is the criticism and reconstruction of the objective world; now if that world is already a perfect and rational actuality, there is no function left for thought to perform. There is no place left for a reconstructive thought which has fruitful connections with the

objective world, but only for a thought which strives to rid itself of its illusions, drag the bandages from its eyes, and gaze upon this perfect, fixed, eternal universe.

In the fourth place this ideal of completeness makes Hegel despise the incomplete and fragmentary character of all practical and scientific investigations. Thus he objects to all finite judgments because of their limitation, because they can never express the whole experience to be had of the object in question, and because his ideal of thought demands such complete expression. Although he recognizes the importance of purpose, this ideal of completeness makes him shun all specific finite purposes and consider only the all-inclusive cosmic Purpose. Of the finite, individual purpose he says that its behavior is the opposite from Truth since it attempts to mold "the world it finds before it into a shape conformable to its purposed End."¹ Particularly are hypotheses subject to this charge of finitude and incompleteness, because they are all limited and specific, because they never deal with all aspects of the subject and because they proceed from specific not cosmic purposes. Thus it is considered a reproach to science that it proceeds lamely by hypotheses and postulates whereas philosophy proceeds by necessity, because its truths are not deduced from any well-authenticated principles but are merely assumed. This account of thought makes impossible any fruitful connection between thought and the world because it makes the forms of thought so fixed and so complete that they cannot be hypothetically or tentatively applied, and makes the world so completely rationalized that it needs no changes which thought might suggest.

Now any good Hegelian would hasten at once to answer these charges thus:

All of your difficulties and inconsistencies arise from the fact that you do not recognize the timeless nature of these categories; you persist in assuming that the deduction of these categories has been finished at some definite time, that there is some specific moment at which the rationalization of the universe would be realized. That is not what Hegel means. He means that the deduction of the categories has no beginning or end but is a timeless reality, that the rationalization of the world is realized not in any one finite period of time but in the all-inclusive and timeless sphere of the Infinite.

To meet the assertion that this completely rationalized world-order leaves no work for thought to do, they would point out many passages in which Hegel specifically urges that this rationality must be produced in finite minds, that it must be worked out in the thought of individual

¹ *Logic*, chap. ix, sec. 232.

men. To answer the charge that Hegel has ignored any finite aspect or value, that he has rejected any finite judgment, purpose, or hypothesis, they would point out that Hegel never rejected anything, that his system was all-inclusive, that he never ignored any of these elements but simply asserted that their finite and partial character was not final, that they should transcend these limitations and be included in a complete whole.

But this is not an answer to the specific charge here urged; for this claim is not that it is impossible to reconcile the timeless contemplation of a completely rationalized world with the need for active criticism and reconstruction of that world by an individual in time; but rather that the method of thought here described, the categories here deduced, can function only in that timeless contemplation of truth already known, and are of no use at all in the learning of new truth. The question here is not how a knowledge that is already complete can need the necessarily imperfect efforts of a finite individual to reproduce it, nor how a rationality which is already accomplished can need to be produced in particular minds; but rather how the deductive necessity and fixed categories can ever be of use in dealing with new specific material. Hegel has tied up all the categories of thought, all the tools for knowing, with an eternally and completely *rationalized* world, and has left the thinker and investigator no alterable or dynamic categories with which to accomplish that *rationalizing* of the world which he also considers necessary. It is not that Hegel ignores hypotheses, and questions, and problems, and tentative ideas, for it is well understood that he allows them to transcend their limitations and become integral parts of one all-inclusive unity. It is that when they are thus included in a complete and perfect whole, they lose their essential characters, they cease to be hypotheses and questions and problems and tentative ideas. It is not that Hegel refuses to include our active, constructive thought, but that when he does include it, it ceases to be the same kind of thought; it ceases to be of any use in criticizing or reconstructing the actual objects of our practical and scientific world. So, in spite of Hegel's sincere attempts to give us a thought which is not merely mental and external but is intrinsically connected with things, in spite of his promise to give us an evolution of the categories which is thoroughly objective, which is really a life-history of objects as they become more completely understood, under the influence of his desire for a rationality which is already completely realized in the objective world, he changes this to a type of thought which is inadequate to our practical and scientific needs.

Bosanquet's *Logic* is a splendid illustration of this fact that nothing tentative and hypothetical can be taken up into a completed system without thereby losing its tentative and hypothetical character. For Bosanquet claims in true Hegelian style that the world is already completely rationalized and systematized, and that the only adequate knowledge is of a complete and finished whole from the nature of which all particulars can be inferred with strict logical necessity. Therefore, although he presents a complete scientific account of induction, in which hypothesis is present from the very first stage, enumerative induction, to the last stage, perceptive analysis, with real, full-grown laboratory methods, he no sooner finishes this account of induction than he declares that real inference is not managed in this way, that true knowledge can never be obtained by this piecemeal work of induction, of procedure by hypothesis. For he claims that any valid information about a particular must be obtained, not from fragmentary and hypothetical inquiries, but from such an insight into the whole system of reality that the nature of this particular can be inferred from the part which it plays in the whole.

I hope to show that Bosanquet's reasons for regarding hypotheses as unimportant, incomplete, and fragmentary, are based on certain conceptions of inference, knowledge, and truth which cannot find place in an adequate account of thought because they demand that thought shall begin at a point where the system of reality is already so completely known that the function of each particular within it is unambiguously perceived, that is, that thought shall begin at the point where everything is already completely known.

These are the main reasons for Bosanquet's exclusion of induction and procedure by hypotheses from completely logical thought:

1. He has defined inference as the operation of a universal or a real identity, a process which depends on such a grasp of the nature of a certain whole that we dare infer that the parts will be of such and such a nature because otherwise they could not perform their respective functions in the whole. Inference must always begin with a whole or a universal and proceed by use of only those particulars which are made necessary by the nature of this universal. We must never infer from one particular directly to another particular, but must always make our inferences from direct reference to the nature of the whole or universal of which they are particulars. Now it is very plain that if this be inference, then Bosanquet is right in asserting that induction is not a species of inference. For the very point about induction is that you

do not know the nature of the universal but are trying to discover that nature, that you do not draw your conclusions because of their necessary connection with a universal, but use hypotheses, analogy, enumeration, observation, and experiment to determine what is the nature of the universal in question. Thus, if inference is to be limited to the necessary and invariable operation of an *already known* universal, it is correct for Bosanquet to say of induction: "It has not . . . for its differentia any peculiar nature in the universal which carries the conclusion. It is consequently . . . a transient and external characteristic of inference."¹

2. Inference depends entirely on the necessary connections of the parts of a coherent system. This coherent system could be discovered in many possible ways, for it has many interconnected particulars, and investigation of any one of them might lead the observer to the discovery of the whole system; it depends entirely on chance just which one of these parts comes to the notice of an individual observer, and, therefore, the method of induction which he follows is entirely accidental. So induction, or procedure by hypothesis, is merely the method which happened to be adopted to discover certain necessary connections of particulars under a universal; it is only the collection of observations and experiments which did in fact disclose a coherent system to a given thinker. Of course some such observation and experiments had to be used to discover this system, but many different ones might have been employed, and it is entirely indifferent just which were actually used. Thus he says:

Its Inductive character belongs exclusively to the process of discovery, and depends on the relation between the elements of the content and the qualification of reality from which the process of cognition starts. Inferential connection is one, and is necessary and invariable; but the points at which a single and coherent system may be in contact with the real world as known to an individual cognitive subject are infinitely various. . . . Inductive proof rests, like all Inference, on systematic and necessary connection of content. How many observations, what experiments, how many, and how favorable conjunctions of phenomena, may be needed to describe the connection to us, is, as Aristotle implied in the Posterior Analytics, theoretically indifferent.²

3. The third reason for rejecting induction and particularly for rejecting procedure by hypothesis, is that any hypothesis limits the investigation to one particular question, whereas Bosanquet's conception of true knowledge is that it must be complete and any limitation of knowledge necessarily interferes with its truth.³ Truth must be whole and

¹ *Logic*, II, 171.

² *Ibid.*

³ *Ibid.*, 267.

complete; it can never be tested by definitely limited investigations, but only by the consequences of its own greater completeness. The following quotation shows Bosanquet's view on this matter:

No history of opinion, no formation of a platform, no idiosyncrasies of mental organization, can come into court when the question of truth is raised. Then we have to do with nothing but the systematic necessity of knowledge and the fact that fuller cognition can compel every false judgment to expose itself as a flat self-contradiction.¹

This seems to assert that any guidance of attention, any examination of one part of the system where we might expect a contradiction to lie, any effort actively to examine or deal with reality is dangerous. Instead, we must be passive spectators while this system of reality unfolds and develops itself, and when the whole is perfectly revealed, then every false judgment will be also revealed. We might object that there does not seem to be any reason why there should be any such false judgments which would have to expose themselves thus, if we remain quiet while this universal reveals itself. We also might object that this systematic whole which is Bosanquet's only test of truth is so clumsy and unwieldy that we cannot see how inclusion in it can ever be any practical test of truth for us. But Bosanquet's answer is that any process which tries to break up this whole and deal with it in pieces small enough for us to handle, necessarily condemns to us fragmentary and partial and incomplete reality.

This is Bosanquet's great objection to the hypothesis—that it leaves out so much of Reality, that it concerns only one very limited aspect of a question, deals with only one very incomplete set of relations between phenomena. All the other rich and varied connections of this particular class of phenomena, those threads which unite it to all the rest of the universe, are ignored, and the attention is narrowed to one infinitesimal fraction of the subject, instead of seeing it in its completeness and totality. If you make a hypothesis about the length of time an animal remains a larva, experiment with specimens to determine this, and come to some conclusion, what a poor, fragmentary view you have even of that insignificant animal, since you have neglected its adult life, its food, its environment, in fact everything except this poor, paltry fact. How can such a fragmentary procedure ever give you truth, since that consists in an inspection of the whole? How can this limited, partial process claim to have any place in that truth which is whole and complete?

Now it is perfectly clear that with these conceptions of inference, of knowledge, and of truth, induction and procedure by hypothesis must

¹ *Logic*, II, 247.

be regarded as unimportant accidents, as limited and incomplete mutilations of the truth, as merely accidental instruments for the discovery of truth. But there are certain inherent difficulties in these conceptions of inference, knowledge, and truth, which makes it extremely doubtful that they can be maintained in an adequate account of thought.

In the first place, Bosanquet's conception of perfect inference applies only to knowledge that has been gained, not in the least to the process by which that knowledge was gained, or by which new knowledge may be obtained. He holds that inference must proceed from insight into a system which is so completely known that the function of each particular within it is known, and it is therefore possible to "infer" the nature of the particular from the part which it plays in the whole. Now when the whole is known in this way, there is surely no work left for thought to do, there is nothing left to infer or think about, there is room only for contemplation of this complete system. So this conception of inference cannot give an adequate account of thought in a world where all the thinking is not yet done, where there are still problems to be solved and truths to be discovered. Looked at as a thing achieved, already known, completed and done, thought has no need of hypotheses and induction. Bosanquet is perfectly right in saying that if you completely know a thing the way in which you found it out is unimportant; and if we had complete knowledge of everything our logics might well discard hypotheses and induction as useless and accidental—but it rather seems that they might also discard discursive thought and mediate knowledge as useless and accidental. The point is that our world is not of this kind. We still need to investigate, discover, and solve problems, and therefore a logic which discards hypotheses and induction is not applicable to our kind of a world.

It is characteristic of his interest in knowledge as complete and forming a system, rather than in the process of acquiring knowledge, that Bosanquet makes no distinction between an inference which contains some novelty and one which does not. He considers an inference to be the contemplation of the relation of parts to each other and to the whole, which is necessary if these parts are to perform their function in that whole. Now we can ordinarily discover this relation but once, but we can contemplate it forever. So, since inference is for him a contemplative and not a discovering process, it can continue indefinitely. For this reason he can say:

And if we live fifty years and see the machine every day, understanding it thoroughly, still the use of any one of its parts, considered as necessitated by the nature of any other actual part or set of parts combined with the working

of the whole machine, remains to us an inference and never becomes a mere fact. Thus novelty or discovery is an accident of Inference.¹

The difficulty with this is that we cannot, as he implies we can, continue to think of that wheel with its necessary connections with the rest of the machine, unless there is some element of novelty to furnish a reason for thinking of it. After we have learned to understand the machine and the relation of its parts we cease to think of it at all, we do not even look at its different parts, until some necessity of mending or improving it, some social interest in explaining it to another, or some theoretical interest in getting our ideas about it into more manageable shape, calls it to our attention. So there must be some element of novelty in inference, for if there were not some new need of thinking about that whole and the necessary connections of its parts, we simply should not attend to it at all, and so should not infer.

Bosanquet's account of knowledge and inference is adequate only as an account of summarizing the results of investigation, of dealing with the conclusions of thinking. It is true that in such a summary hypotheses and induction have no real place; they are merely digressions from the main point, which is to display the necessary connections of the particulars without reference to their mode of discovery. For example, if a certain fact concerning the adult life of frogs were discovered through an analogy suggested while working with tadpoles, the scientist would, nevertheless, in writing a life-history of the frog, put this fact in the section dealing with the adult life of the frog, rather than in the place where it was first suggested. He might quite properly ignore as entirely accidental and unimportant the method of this discovery. But if he were not writing a life-history of the frog, but were giving an account of his scientific procedure in investigation, it would be a mistake to ignore this method by which the given fact was first suggested. It is because Bosanquet is claiming to give an account of all thought, not just a summary of the conclusions, that it is a mistake for him to exclude as unnecessary and accidental the methods by which these conclusions are reached.

Another objection to Bosanquet's position that real inference begins only when the concrete systematic whole and the necessary relations of its parts are known, and when insight into this whole enables us to infer certain things which must be true about these parts if they are to perform their function in that whole, is that it fails to provide any method for extending an incomplete conception of that system or for correcting a

¹ *Logic*, II, 8.

false conception of it. For if our idea of this whole is incomplete or false, no inferences can modify that idea because they depend upon it, and are conditioned by it. Therefore, if our idea of this whole is to be modified, our deductions from its nature must be compared with our experiments and observations to see whether they support or contradict these deductions. This is another reason for holding that, until our knowledge is absolutely perfect and complete, inference cannot be independent of these processes which Bosanquet calls mere accidents of inference.

Lastly, Bosanquet's conception of knowledge and truth as that which is whole, complete, and without limitation is one which would make it impossible for us ever to know any truth. He points out that all our experimental and inductive inquiries are limited and partial, concern only a poor fragment of the universe, and can never give us that truth which consists in a view of the complete whole. Therefore, he asserts that we can never obtain truth by this process of limiting our attention, dissecting our objects, dealing with paltry fragments of reality. It would be much better for us to observe quietly and refrain from disturbing the process, while the universal reproduces itself in systematic fashion, and then there will appear complete truth. Still, even if there were a choice between these two methods of obtaining knowledge some of us would prefer to work and modify conditions and find out one very small fact which gave us some slight power of working with our environment rather than to watch the whole universe unroll itself before our wondering eyes. For example Lessing has imagined himself given by God his choice between complete truth and power to search for truth and has declared that he would choose the power to search for truth. But in sober fact we do not have this choice. The only choice we have is between the partial knowledge which we must work for actively, and no knowledge at all.

As Poincaré says:

When a zoölogist dissects an animal certainly he alters it. Yes, in dissecting it, he condemns himself to never know all of it; but in not dissecting it, he would condemn himself to never know anything of it, and consequently to never see anything of it.¹

Such passages are surely enough to show that the conceptions of inference, knowledge, and truth, which force Bosanquet to reject induction and procedure by hypothesis as accidents of inference, belonging only to the process of discovery and playing no part in true knowledge,

¹ *The Foundations of Science*, p. 322.

are conceptions which make an adequate account of thought impossible, because they limit it to a summary of the conclusions of thought, with no reliable method for obtaining, for modifying, or for correcting those conclusions, and because they make any true knowledge impossible for us to obtain, since our scope of attention cannot be unlimited.

Holt is even stronger than the idealists just discussed in his contempt for the hypothesis, for he not only asserts that completely logical thought cannot proceed by hypothesis, but also that science does not need hypotheses, that "the scientific world today works very little with hypotheses"¹ and that the conscientious scientist constructs nothing, but seeks "to efface his personal will, and if it were possible he would transcend the limitations of his sense organs, so as to be an impartial witness of the events."² Holt supports these contentions by statements from Newton, Ampère, Kirchhoff, and Hertz, showing their distrust in the hypothesis. But these very statements show clearly that these scientists had been taught to think of hypotheses as mere fancies and fictions of a wholly subjective "mind" and naturally rejected them, whereas in practice they did make use of the true hypothetical method.

Holt himself admits that Newton used hypotheses, although quoting his assertion, *Hypotheses non fingo*, in support of his position.³ Ampère's statement is this:

The principal advantage of formulas which are obtained as the direct result of observations numerous enough to be incontestable is that they are independent of all hypotheses, whether of such hypotheses as the discoverers of the formulas may have employed in the course of their investigations, or of such as may later come to be in vogue.⁴

Now this quotation specifically states that the discoverers of these formulas "may have employed" hypotheses in their investigations, and yet it is brazenly used by Holt to prove that science has nothing to do with these same hypotheses. Ampère's statement truly means that the formulas *which are obtained by hypothetical procedure* need to be verified by their agreement with "observations numerous enough to be incontestable." His use of Hertz as a denouncer of the hypothesis is even more unfortunate, because Hertz gives a very specific account of the scientist's use of the hypothesis, saying:

The process by which we succeed in deducing the future from the past, is always this: we fashion for ourselves mental images or symbols of outer

¹ *The Concept of Consciousness*, p. 129.

³ *Ibid.*, p. 129.

² *Ibid.*, p. 130.

⁴ *Ibid.*

objects. . . . If now we have once succeeded in constructing out of our total previous experience images of the required conformation, we can in a little while develop from them, as if from models, the same consequences which will appear in the outer world after a longer time, or perhaps only after our own physical interference.¹

Now it is this use of thought, this use of mental symbols and images, which Holt's theory is unable to account for; therefore, he asserts that Hertz was mistaken in holding that these are constructed by the mind; and, unjustly enough, quotes another statement where Hertz rejects hypotheses (by which he doubtless meant purely subjective fancies), to prove that he could not have been right here in holding that these mental symbols and images were any help to him in investigation.

Surely such quotations cannot be thought to prove that these scientists had no need of hypotheses, since these same men themselves stated clearly that they did use hypotheses; they can only prove that after they had been taught that hypotheses were only subjective fancies and guesses they did assert the uselessness of hypotheses as so defined.

It is a strange proceeding to include Holt among these idealists, and yet in this matter his position is very like theirs. His main motive in excluding hypotheses is exactly the same as theirs, namely, the desire for a complete and finished knowledge system from which all particulars can be obtained. Also he shares their conviction that this can be realized only by a strict deductive process, and shares, too, their unwillingness to admit the value of selected and fragmentary information obtained by hypotheses and inductions because such piecemeal contributions can never build up this complete system of truth. He also shares their conviction that the act of thinking is entirely subjective, and in order that he may free logic from the errors of this act, he rejects all hypotheses on the ground that they are "deliberately added to the facts," and asserts that the individual in fact constructs nothing in science or logic, but merely looks at what lies before him, that he is, as Holt himself puts it, "a mere impartial witness of events." Now in all this Holt fancies himself very different from the idealists, he thinks he sees their errors, and is planning to escape from them. But he is following them closely in his conviction of the subjectivity and error of the finite individual, and in the necessity for a complete and finished system which unrolls itself before a passive spectator. Therefore, it is not surprising that he should fail at exactly the same point at which they fail, namely, that he cannot make his account of thought apply to the discovery of any truth,

¹ *Ibid.*, pp. 124-25.

but only to the systematization of knowledge already gained, that the only way he can work his complete and perfect deductive system is by beginning at the point where all the discoveries have been made, where all the investigations have been completed.

The examination of an example which Holt gives in proof of his contention that all coherent thought is deductive will justify the assertion that his theory applies only to a situation where everything has already been discovered, and not at all to a situation where something is being investigated. He takes the case of the description of mollusc shells. He supposes that the biologist has decided to describe them in order of their size and points out that this "principle of order" determines their arrangement in a thoroughly deductive manner. Once it is adopted, the place of each shell is decided by strict logical necessity. Of course the principle cannot determine that there shall be a shell 4 cm. in diameter, but it can determine with logical necessity that if there is such a shell it must be placed between the shell which is 5 cm. in diameter and the one which is 3. This is just as true for the man who classified the shells as for any visitor; neither of them could change the order which deductively unfolds from this law or "principle of order," both are therefore mere impartial observers.¹

In all this Holt is perfectly correct. After a principle or law is adopted it does order the facts to which it applies with strict "deductive power"—only, after this principle or law is adopted deduction is mere mechanical measuring of shells and arranging them in the way decided upon. It is hard to see why Holt says with such pompousness, that when once you decide to arrange shells in the order of their size, you can "deduce" with inescapable logical necessity the place of each and every shell, the necessity that a shell 4 cm. in diameter must come between one 3 and one 5 cm. in diameter, since this is absolutely nothing except a full statement of the law or principle you have adopted, and once that principle is adopted there is nothing left to deduce. If Holt had wished to talk about really significant thought he would have begun before the "principle of order" was adopted, or while it was still open to change.

But Holt says nothing about how the classifier came to adopt this principle of classification, or how the observer can discover it, and thus he ignores one very important fact, namely, that the classifier could not have been a mere impartial spectator when he decided to adopt just that "principle of order," nor could the visitor have played a merely passive rôle while discovering it. Yet both classifier and visitor must in some

¹ Holt, *The Concept of Consciousness*, pp. 55-57.

way obtain this "principle of order," for he points out that the facts will be "chaotic and unintelligible unless the classifier has some principle of order," and on the other hand, until the visitor ascertains this principle, the collection will be mere chaos to him, and "he will spend his time quite as wisely in scrutinizing random pebbles on the beach." Yet in spite of the importance of these "principles of order," their origin is never once investigated; it is simply taken for granted.

In truth Holt's ideal scientist can do nothing else but take them for granted because he must be a mere impartial witness of events, effacing his personal will and even trying to get away from the limitations of his own sense organs, so that he will put absolutely nothing of his own into the facts, which are simply to be reported as found.¹ Now if this ideal scientist really followed such a program he would have to set forth all his observations without any "principle of order," which Holt declares would result in a mere chaos. That would be the best this scientist could offer. Therefore, Holt cannot discuss the origin of these "principles of order" because mere observation can never give them, and yet they are absolutely necessary. So the only way in which he can make it appear true that a mere impartial spectator can discover the truths of science is by starting at the place where the laws or principles have all been adopted, that is, at the place where all the real thinking has been done.

Even in this process of classification, a discussion of its origin would have exposed the fact that an active mind must in some way have chosen that "principle of order," although a passive mind might very well follow it out, once it was chosen. Holt would have objected to this, because it seems to him that to admit that an active mind could select what law or principle to use, makes that principle seem arbitrary, fanciful, subjective. It seems so only because his "mind," although deduced from neutral entities, is the same sort of a subjective, shut-up-in-itself "mind" which Bosanquet has been laboring with.

In fact, when you really examine these "principles of order" which he so carelessly assumes, you see that they are actually hypotheses, which are tentatively adopted to classify facts, are modified and changed when applied to these facts, and are finally accepted. Only when thus accepted are they mentioned in Holt's society. The same theory of the subjective act of mind which kept Holt from associating with these "principles of order" while they were still in the tentative and experimental stage makes him ignore all hypotheses. Since he believes that

¹ *Ibid.*, p. 130.

all truth must be discovered by merely opening your eyes and looking at it, and not by any kind of investigation, and since he believes that any actual active use of the mind or will introduces whims and fancies into science, he must get along without any use of the hypothesis at all. In this he is perfectly consistent. He foreswears all commerce with any variety of mental construction, and draws his deductions merely from the observed facts. To do this, he must assume that the facts are given without question or ambiguity, and that by careful scrutiny of them you can find the theory which lies within them. Thus he says of the laws which scientists are seeking that they can be observed and need not be constructed, that they "are not hypothecated or constructed 'to fit' the facts, they are found in the facts; and the process of formulation is not one of construction, but of abstraction, of analysis."

Now when I assert that Holt's reason for insisting that there is no constructive act in investigation, for rejecting hypotheses, and for refusing to discuss the origin of his "principles of order" is that he considers the act of construction entirely psychic and subjective, I am aware that he could well protect himself from this charge by pointing to his conception of consciousness, which certainly emphasizes the responsiveness and activity of consciousness. There Holt defines consciousness as that cross-section of the world which is made up of the responses of a creature with a nervous organism to the environment. Surely this definition could not be accused of depicting a mind which is merely a passive bystander, for this mind is a cross-section of actions and responses; it certainly does not exclude the act of thought, for it represents the mind as made up of just such acts of thought.

Nevertheless, this account of consciousness cannot protect Holt from this criticism of his theory of knowledge, since he does not and cannot use the kind of consciousness here described in that strictly deductive process by which he claims to obtain all knowledge. This conception of consciousness as a collection of responses does not in any way agree with the view that all one needs to do is to open his eyes and stare at objects and he will necessarily see the truth, if only he avoids those wilful whims and fancies which alone introduce error. This account of consciousness is likewise inconsistent with the notion that the ideal scientist should merely watch the events which unroll themselves before him, should be careful not to put anything of his own into the facts, should try to efface his personal will and even to get away from the limits of his own sense organs, in order that he may report the things before him exactly as they are found. In fact, so inconsistent are these

two parts of Holt's theory, that if his ideal scientist were completely successful in this attempt, he would have no consciousness at all, according to Holt's definition, for there would be no response of his nervous organism to the objects before him, there would be merely those objects themselves. Therefore, if Holt should object that his view of consciousness as a cross-section of the responses of a being with a nervous system to his environment saves him from the charge of considering the mind merely subjective and entirely passive, it could be answered that the consciousness thus defined could never become the "mere impartial witness of the events" which the rest of his theory demands.

Holt has an objection to all thought, which is like Bosanquet's objection to the hypothesis because it deals with only a few meager aspects of truth, and which originates in the same inadequate view of the mind and thought. Holt claims that the concepts of science should correspond with the objects, and "their 'correspondence' with this or that feature of the universe of time or space is their identity therewith." He then asks the very pertinent questions: "Why should we have these necessarily limited concepts? Why should we ever bother to think at all?" His answer to these questions is that only in the realm of the concepts can we get any necessity, only by framing a thought system deductively can we get any absolutely necessary laws. Of course we cannot be sure that any particular facts will fit into the system, but that makes little difference, all he wants is so to define his system that he can determine just what particular facts could go into each class if these facts should appear. So thought is allowed no influence on particular facts, but is limited to making definitions of classes which can be governed by absolutely necessary laws because, if particulars do not meet these specifications, then they are not admitted into the defined classes. The reason he is thus content with merely defining classes is that he has shut himself up to the kind of a mind and the kind of truth which makes any investigation or manipulation of particular facts impossible and so the construction of classes is the only exercise possible. If he had recognized the truth which Mill knew empirically, although he could find no room for it in his system, that we rearrange our thoughts in order that their arrangements may suggest rearrangements of things he would have found a better answer to his question: "When we have the concrete particulars, why seek to parallel these with merely, and always partially, corresponding or identical abstract entities?"

He would then have realized that it is just because thought does not exactly correspond to its object, because it can abstract from the whole

and deal with only those aspects which are important for its purpose that it is of use to us in dealing with objects.

There are, to be sure, wide differences in the accounts of thought given by the logicians here grouped together, but the grouping is justified by the fact that the main interest of each of these logicians is in a complete and finished system of thought, and that they all consider any incompleteness or relativity a blot upon the character of knowledge. Naturally, then, their interest had to be in the finished product of thought and its systematic deductive relationships, not in the method by which this product was obtained. For such an all-inclusive system can never be obtained by hypotheses which are necessarily limited and specific, by any piecemeal investigations, or collections of empirical evidence; such partial undertakings can never give the desired necessity and completeness. Some of these logicians make a separation between thought and the world, and some of them declare they are in the closest connection, but all of them have to admit that the thinking of finite individuals is always partial and limited and can never give the kind of complete knowledge they desire. Hence they all have to exclude the activity of the individual from any legitimate knowing process and to rest this process upon the operation of some categories, the reproduction by the universal of its own differences, or the deductive and necessary action of certain principles of order, which the individual merely watches and does not interfere with. All offer as the best possible proof of the validity of a certain process the fact that the finite individual had no part in it. In such systems hypotheses cannot possibly have any place; for they are always limited to some specific phase of a situation, to some particular problem, and in their systems limitations are signs of failure; they are always held tentatively and experimentally, whereas the demand of these logicians is for indubitable necessity; they are always the tools of finite individuals, but any act of the finite individual is ruinous to their ideal of thought.

If any of these logicians had succeeded in giving a truly adequate account of the thinking which is actually done in practical and in scientific matters, it would have been necessary to abandon the contention that hypotheses are necessary to thought. But true to the theory here advanced the exclusion of the hypothesis involves with it the exclusion of all practical and scientific thinking, all discovery, and all investigation. From the category of causality nothing can be deduced concerning the cause of any specific phenomenon. It is mockery to say to a scientist

who is seeking to discover whether an ion is simple or complex: "If it is consistent with the whole then it is true," or "Wait until the concrete universal reveals that, as it manifests itself in its own differences," or even, "You can trace it from the pattern in which the ultimate elements form themselves." This is not to blame the logicians in question because they do not solve that specific problem, or any other specific problem; such solutions belong to the special sciences. But it does blame them for giving accounts of thought which have no place for any type of thinking which could ever make any attempt to solve such problems. It does blame them because they begin their accounts of thought where the system of reality is so perfectly known that the function of each part of that system is known and its nature can be deduced from that function, where all experience is coming to the mind unambiguous and already shaped to fall under its own proper category; for whenever it is possible to have such a complete system embracing all particulars, then the work of thinking is already done. Such thought cannot make any fruitful connections with things, cannot criticize or reconstruct objects, for the very simple reason that before any such thought is possible, all work of this kind must be finished.

CHAPTER IV

CONCLUSION

On the positive side, then, what must be the characteristics of a logic which can find a place for hypotheses? What must be true of any logic which avoids those misconceptions concerning the nature of thought which make it impossible to give an adequate account of our ordinary experience of discovery and investigation in science and practical affairs?

In the first place a logic which is going to account for hypotheses must maintain the closest possible connection between thought and things. A hypothesis is at the outset a proposed method of dealing with conflicting objects. It must needs be held tentatively and experimentally, and must be modified in the course of the solution of this conflict. Otherwise it would lose all its value as a means of dealing with ambiguous objects. If it came entirely from the "mind," how could it help in any way to deal with the "facts"? How could it even be sure to refer to these "facts"? If it came entirely from the "facts," what could thinking add to perception? How could the hypothesis given by the facts to a receptive mind be different from the facts themselves?

Such a connection between thought and things is not only necessary for hypotheses but for any satisfactory account of thought. For if a complete separation is made, then it is impossible to show how a wholly subjective thought can ever have anything to do with equally objective things. Therefore, it is necessary either to assert that the thoughts made up by the mind do not apply except by accident to anything in the objective world, and that if some of them do apply by accident the mind can never know the fact; or else to assert that in spite of their separation, some external force, such as the will of God, the uniformity of nature, or the action of the concrete universal, insures correspondence between them. The trouble with the first way out of this difficulty is that it lands in total skepticism, since no knowledge can ever be true of the objective world; and the trouble with the latter is that it makes errors and mistakes inexplicable, since all thoughts miraculously correspond to their objects. The philosophers we have discussed tried to escape this difficulty by the contradictory compromise of making these hypotheses and mental constructions the cause of error and mistake, and asserting that they have no correspondence with real things; and on the other

hand, by making those sense impressions, simple ideas, absolutely true representations of external reality. The inconsistencies of this compromise have appeared in the detailed study of the logicians treated above, and besides, it is patently contradictory to hold that the falsity of all hypotheses is due to the natural depravity of the human mind, and at the same time to insist that the truth of all simple ideas is due to the innate perfection of that same human mind.

The only way for a logical system to avoid these difficulties is for it to start with the "mind" and "things" in such interconnection that their correspondence will not have to be either a miracle which could never fail, and therefore give no room for error, or an impossibility which could give no room for true knowledge. There are many logicians who claim that this is an unwarrantable assumption, since it takes for granted the very issue in discussion. The best answer to this objection seems to be that without this assumption no account of knowledge is possible, and that it seems to be thoroughly justified by experience. For our experience never shows us isolated minds going around thinking, observing, contemplating, entirely without connection with their bodies, their environments, their daily tasks, and their place in the social and physical world.

The examination of some simple cases of everyday thinking will show how close is this connection between thought and things, between ideas and the observations made by the senses. Such an examination will prove conclusively that the ordinary problems of everyday life are not solved by the action of separate "things" which mechanically register themselves upon an isolated "mind," but by an intimate interaction in which the ideas are modified by the observations and the observations are modified by the ideas. For example, if you go out in the morning and find all of your tomato vines dead, and if you wish very much to know what has killed them, you do not stand and stare at them dumbly as "a mere impartial witness of the events," nor do you rush about collecting all of the "objective facts" about those vines. You do not measure the height of the vines, count the number of blossoms on each one, weigh the tomatoes, measure each leaf, make a chemical analysis of the soil, and investigate all worms and insects found on or near the vines, and obtain statistics concerning the temperature and rainfall in the past years and compare them with other years.

Instead of this elaborate process, you probably stand and look at those vines a few moments, think of things you know about tomato vines and cases of their destruction which you have heard about. You

may remember hearing of a case where worms destroyed tomato vines, or you may see a worm on one of the vines. In that case you examine the leaves carefully to see whether some of them have been eaten. Or you may remember that it was cold last night and that tomato vines are delicate in which case you examine the leaves also, but this time for signs of frost, not for signs of worms. Or you may think it was a cut-worm, in which case you will ignore the leaves and examine the roots. My point is that in no case are you merely the passive receptor of given and fixed observations or "facts" about those tomato vines. In every case you hold some explanation tentatively and experimentally, and in reference to that explanation you consider some factors and ignore others.

Now this is the action which our introspection assures us actually takes place when we are solving commonplace, everyday problems, and these tentative and experimental explanations or suggestions which guide our selection of material are really hypotheses. Likewise in scientific investigation even a casual study of the investigations of Pasteur to discover the cause of anthrax among sheep, or of Darwin to discover the effects of cross-fertilization and self-fertilization among plants would assure any reader that they did not merely open their eyes and look at certain fixed and given "facts," that they did not passively receive a number of separate and external observations, but that from the very beginning they were guided by some theory which was held only tentatively, that this theory guided their observations and experiments, that when this theory proved inadequate they modified it, and even in rare cases, abandoned it entirely and sought another, but that they never sought to collect all possible facts without any suggestion at all concerning a theory to which they were related, and that they never merely stood and looked at the phenomena waiting for them to display an answer to their query.

This examination of concrete cases of thinking shows quite conclusively that experience cannot be split into subjective mind and objective things, but that both are interacting freely when thought is going on. Actual cases of thinking activity do not reveal wholly external observations mechanically impressing themselves upon a separate mind; they show instead that the observations made, the facts noticed, are selected and determined by the ideas entertained, by the expected solution of the problem, by the tentative hypothesis, and that, on the other hand, those ideas and hypotheses are being constantly modified by the observations which are made. There is always some idea, some hypoth-

esis which causes the thinker to attend to certain factors of the situation and to ignore others, and this idea or hypothesis is constantly changed and modified as a result of the phenomena observed.

When we say that we must have hypotheses to work with in our scientific and practical thinking, we mean that we must have some content which is more completely under our control than material things are, which can be more easily changed and manipulated, so that the results of these changes and manipulations can be deduced, until some combination is found whose results satisfy the demands of the problem, and then these changes and manipulations are made in the actual material things. We mean that you cannot actually change every material circumstance which might directly or indirectly influence those tomato plants; if you did, it would take many centuries to solve that problem. Instead of this you can hypothesize these changes, deduce their consequences, compare these consequences with the actual state of the plants, perform the suggested experiments, and thus find a combination which really answers your inquiry. We mean that when an inventor makes a machine, when an architect draws plans for a house, and when a woman makes over a dress they cannot actually try every combination of materials which suggests itself. Instead they tentatively adopt one suggestion, develop its probable consequences, change it until these seem satisfactory, then arrange their material according to the suggestion; if that does not satisfy their demands, if some results they did not foresee spoil the application, they try to modify the suggestion to avoid this unfavorable result, and so continue until a satisfactory suggestion is found. Then they arrange their materials, their rods, and beams, and cylinders, and valves, their serges, and silks, and braid, according to the accepted suggestion. All of which shows that when we say we must have hypotheses, we mean that we must be able to hold some suggestion in suspense as an idea, to develop its implications and deduce its results, conduct experiments which will show and test those results, remold it according to the demands of these experiments, and finally apply it as a mode of readjustment to that situation whose problems and inconsistencies first aroused the investigation.

The hypothesis is not an entity or an existence, but rather a plan of action. It is not a fancy or a mere fiction of the imagination, but something which functions to get us out of inconsistency and trouble in an objective world, and which gets its application and its test of validity in that same objective world, but which, in the meantime, for the sake of efficiency operates as a thought, as an idea. By using hypotheses to

deal with suggested readjustments and modifications we can short-circuit the process. From which it follows that hypotheses are necessary to science and to the conduct of practical affairs.

If we can once succeed in recognizing the closeness of this connection between those plans of action or ideas which make us notice certain phenomena and ignore others, and the things thus noticed which immediately proceed to modify and alter the ideas or hypotheses, we shall then cease to be imposed upon by a logic which presents to us wholly subjective hypotheses which can be tested only by their completeness and consistency, and which will always need some external guaranty to explain how they can be connected with a separate external world. We shall then recognize clearly that hypotheses are merely ways in which thinking beings deal with other beings, when other ways are inadequate, and are therefore no more "subjective" than are the thinking beings and the other beings. Similarly we shall not be imposed upon by a logic which insists that things all by themselves give knowledge, because we shall know that knowledge is the result of an interaction of a thinking thing with other things; moreover, we shall know that the thinking thing cannot be a mere sensitized plate upon which the objective world registers its facts. We are sure of this because a mere sensitized plate could never make up errors, because a "mind" which merely receives can never account for those mistakes which always exist in our knowledge; and also because the meaningless mass of undifferentiated sensations, the big, blooming, buzzing confusions, which confront us in those rare moments of experience when we feel entirely passive from weakness, lack of development, shock, or some other unusual situation, are not at all like our ordinary knowing processes.

From all of this comes the conviction that only a logic which recognizes the fact that thought is a function of thinking organisms, of thinking things, of intellects in the closest connection with hands and feet, will be able to account for hypotheses which are not subjective guesses or donations to a passive mind from objective things, but are rather plans which arise when a reflective being is in the presence of other beings and finds those beings ambiguous so that he is unable to take a definite attitude toward them. Then begins a period of mutual adjustment, a modification of the plan because of certain discoveries concerning the things, a reclassification of them, their rearrangement in experiment, their modification and manipulation because of the demands of this plan or hypothesis, an interaction between fact and hypothesis which is found in all science and in all practical experience and which no logic

can possibly account for without postulating the closest possible inter-connection between thought and things.

In the second place, any logic which is going to give an account of thought which has a place for hypotheses must abandon the separation between "theoretical" and "practical" thinking. It must recognize the fact that we think in order that we may take a definite attitude toward other beings, an attitude of loving, fearing, fighting, buying, painting, praying, making. On the face of it this proposition seems so plain as not to need any emphasis, for we know that in our ordinary experience we seek to find out why the bread was heavy this time in order that we may make it light next time, that we study yellow fever for the sake of curing and preventing it, that we study law in order to plead cases, architecture in order to plan buildings, and dentistry in order to care for teeth. But there are many logicians who feel that while there is this "practical" type of thinking, there is also a higher and truer type of thinking that has no specific end, but only the general end of increase in wisdom, that the legitimate logical activity will not be directed to the solution of specific problems, but to that growth in universal wisdom which is the individual's true destiny. They also urge the contention that even in practical thinking if one limits the purpose of his thinking too narrowly he defeats his own end; if he conducts his logical activity for the sake of narrowly conceived practical activity, he is not able to reap the full results of his undertaking. Thus one who thinks about the cause of this bread's heaviness merely for the sake of avoiding that particular cause of failure will perhaps ignore the general principles of bread-making because they have nothing to do with this special failure and so will make many other mistakes while avoiding that particular one. If physicians had conceived their purposes too narrowly they might easily have continued for generations to treat yellow fever and have ignored as utterly unimportant the habits of mosquitoes. Instead of drawing from this the warrantable conclusion that knowledge must not be restricted to that which is immediately applicable to action, that our logical processes must not be narrowly restricted to their practical application to one particular perplexity, but should conceive their problems as broadly as possible, they draw the utterly unwarrantable conclusion that any application to practical activity is an illegitimate restriction, that logical process should not aim at any particular control of the environment, no matter how inclusive, but should aim first at that increase of general wisdom which will make all such control possible. Seek first the kingdom of universal truth and all things else shall be added unto you. This is to demand

that thinking shall work with nothing to work upon, shall exercise the mind for the sake of its growth in wisdom, but shall use no specific forms of exercise.

Now this separation of thinking from other activities and specific problems of any sort inevitably makes it impossible to give the hypothesis its due. For, in the first place, hypotheses are necessarily limited to some specific purpose, point directly to some particular control of the environment. This purpose and control may be very inclusive; they may be as broad as the study of gravity, evolution, or the conservation of energy. Nevertheless they will be specific, they will apply to some particular range of subject-matter; no one could ever make a hypothesis concerning increase of wisdom in general, with no specific limitations. In the second place, hypotheses have no value by themselves, but must be hitched up with interests, actions, for they arise only when there is some conflict in these. Their purpose is to find the cause of that conflict and remove it, and if logical activity is deprived of any connection with other activities then it can have no ambiguities or difficulties and, therefore, no need of hypotheses.

It follows from this requirement that our thinking be knit up with our other activities, that the goal of thought cannot be the contemplation of some complete, comprehensive, finished whole, in which all the particular elements find their places, but must be experimental. Therefore, its account of thought must not begin where the "principles of order" have been determined upon, where the system and the function of each part within that system is already known, where the categories of thought are fixed, and where nothing remains to be done except to deduce the results. Instead of this its account must begin where the experience cannot be complacently accepted, where it is not satisfactory just as it is given, where some "principles of order" have to be determined, where the function of some part of the world is ambiguous, is equivocal, where some question is to be answered.

It also follows from this requirement that thinking be connected with other activities, and recognized as a control for them, that the ideal of thought must be the solution of specific problems, not the contemplation of a finished system. It must be recognized that experience is too vast to be dealt with wholesale, and that the problems of logic, like Dewey's problems of morality, must be viewed as retail jobs. It must be admitted that we may limit our inquiry without thereby rendering our results false, that partial knowledge is not, therefore, useless and untrue. This must be recognized because the very nature of a hypoth-

esis is to limit, to select, to direct an investigation "to one thing rather than another," and this characteristic of a hypothesis is necessary if we are going to have a thought which can discover new facts and not just systematize ones already known; because we can never learn all about the world, all at once, we must always attack one question at a time.

Last of all, any logic which is going to give an adequate account of the hypothesis must recognize the fact that immediate experience is ambiguous, that our very sensations suggest doubts and questions, that there are conflicts and contradictions in the stimuli themselves. For if the facts were unambiguously given to the mind, there would be no problem of knowledge any more than there is a problem of vision. Knowledge would have to arise simply by the contemplation of the facts as they come, and any hypotheses about them would have to be either useless mental luxuries or positive perversions of the given facts and causes of error. If every stimulus our organisms could receive were absolutely distinct and different from any other stimulus, and if each of these stimuli always needed exactly the same reaction, so that there could never be any ambiguities or conflicts, then there would never be any need for forming hypotheses, for forming ideal explanations of what we saw, deducing their results, and subjecting these to various experiments. But in the world of our experience, one stimulus is not always easy to distinguish from another; it often comes as an equivocal stimulus, whose problematic and hypothetical aspect is suggested in the very moment of its reception, by its own ambiguity. Thus if facts were unambiguously given, so that feeling a drop of water hit against your face always meant a hard rainstorm coming, that sensation would be merely received and recorded, there would be no occasion for any hypothesis in connection with its reception by the mind. If we are going to have hypotheses then, we must admit that all stimuli are not thus unambiguous, that sometimes it is a drop of rain from a storm, and sometimes one from a lawn sprayer placed too near you. Then the given sensation will be hypothetical in its very reception, will itself suggest the question, "Storm or lawn sprayer?"; the hypothesis will not be unwarrantably lugged in from the outside and added to facts which have no need for them, but the facts will themselves arouse the hypothesis because they are questioned facts. Thus we shall know that the facts do not stand off on one side, absolutely complete and certain and presented in that neat form to the mind, which then officiously attaches some hypothetical fancy of its own to them, but that these facts come

before the mind as themselves questionable, ambiguous, puzzling, and simply demand some kind of explanation to make them understandable.

For this same reason, a logic which is to consider the hypothesis at all legitimate must not follow the anti-intellectualists in asserting that unified reality is given in immediate experience and that thought is essentially mutilative and disjunctive. It is because an immediate experience suggests two contradictory lines of reaction, because we do not know what to make of it, because it splits up into conflicting stimuli to action, that we must make hypotheses and follow out their deduced consequences, to determine which of these reactions to make, to cure this disjunction in our immediate experience. If all the elements of my immediate experience with those tomato vines point to the one conclusion, they were killed by frost, I do not make any hypothesis, I do not go through any logical procedure whatsoever, I merely say, "They were killed by the frost." It is only when the immediate experience gives not a unified but an ambiguous message, when some signs which I have always considered necessary to destruction by frost, for example, blackened leaves or fall in temperature, are lacking, or when other signs are present also, which point to destruction by worms or rabbits, that I follow out these rival hypotheses, and seek to explain these contradictory elements of the situation. That is to say, the immediate experience in this case comes to me already mutilated, and it is the office of thought, beginning with one or more hypotheses, to solve the ambiguity, to establish one cause and do away with the contradictory causes suggested. Also, the cause is so much a part of the immediate experience with which I start, that this experience will not cease to be ambiguous until the cause is determined. Now if the anti-intellectualists were right in saying that immediate experience is always unified until thought mutilates it, then there would never be any ambiguous situations which could give rise to hypotheses, and they would vanish immediately from human minds or rather would never have arisen in the first place. The only other possible theory is that the making of hypotheses is only another sign of innate human depravity, dragging in ambiguities and contradictions into a perfectly unified and satisfactory immediate experience, reading problems into a situation which is absolutely clear and unequivocal. Therefore it is necessary for a logic which would consider hypotheses legitimate at all to admit that immediate experience contains conflicts and problems.

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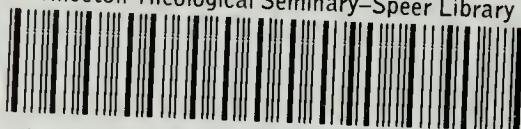
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